



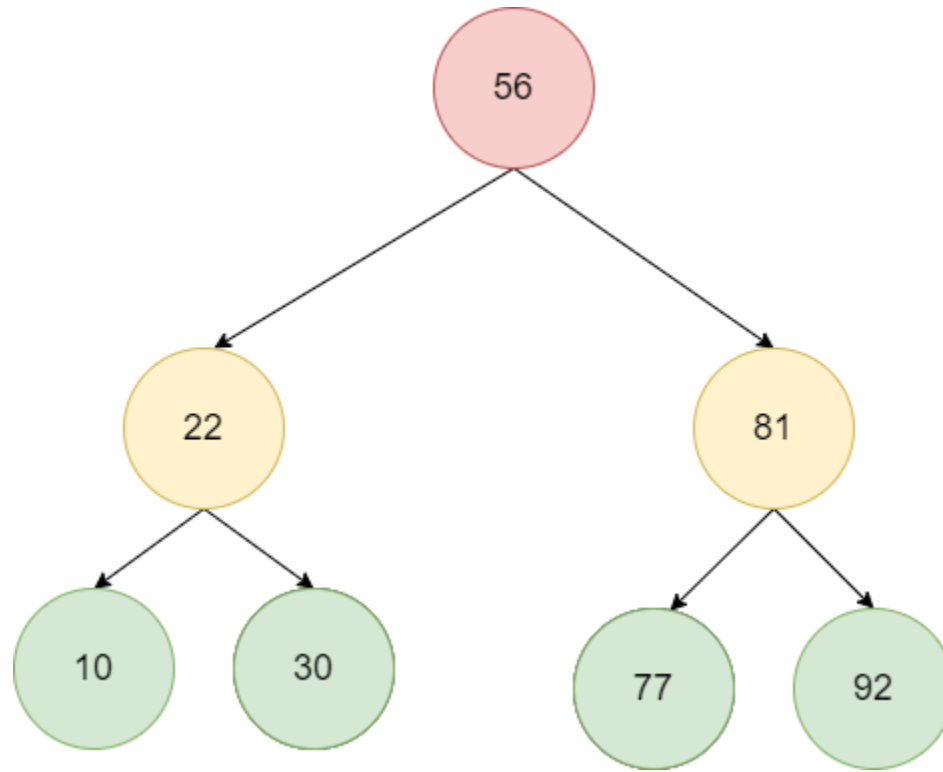
Giriş

1. Ağaç tanımı
2. Ağaca eleman ekleme
3. Ağaçta dolaşma
 1. Inorder
 2. Preorder
 3. Postoder
4. Minimum değeri bulma
5. Maksimum değeri bulma
6. Bul metodu tasarımı
7. Ağaçta silme metodunu tasarlama

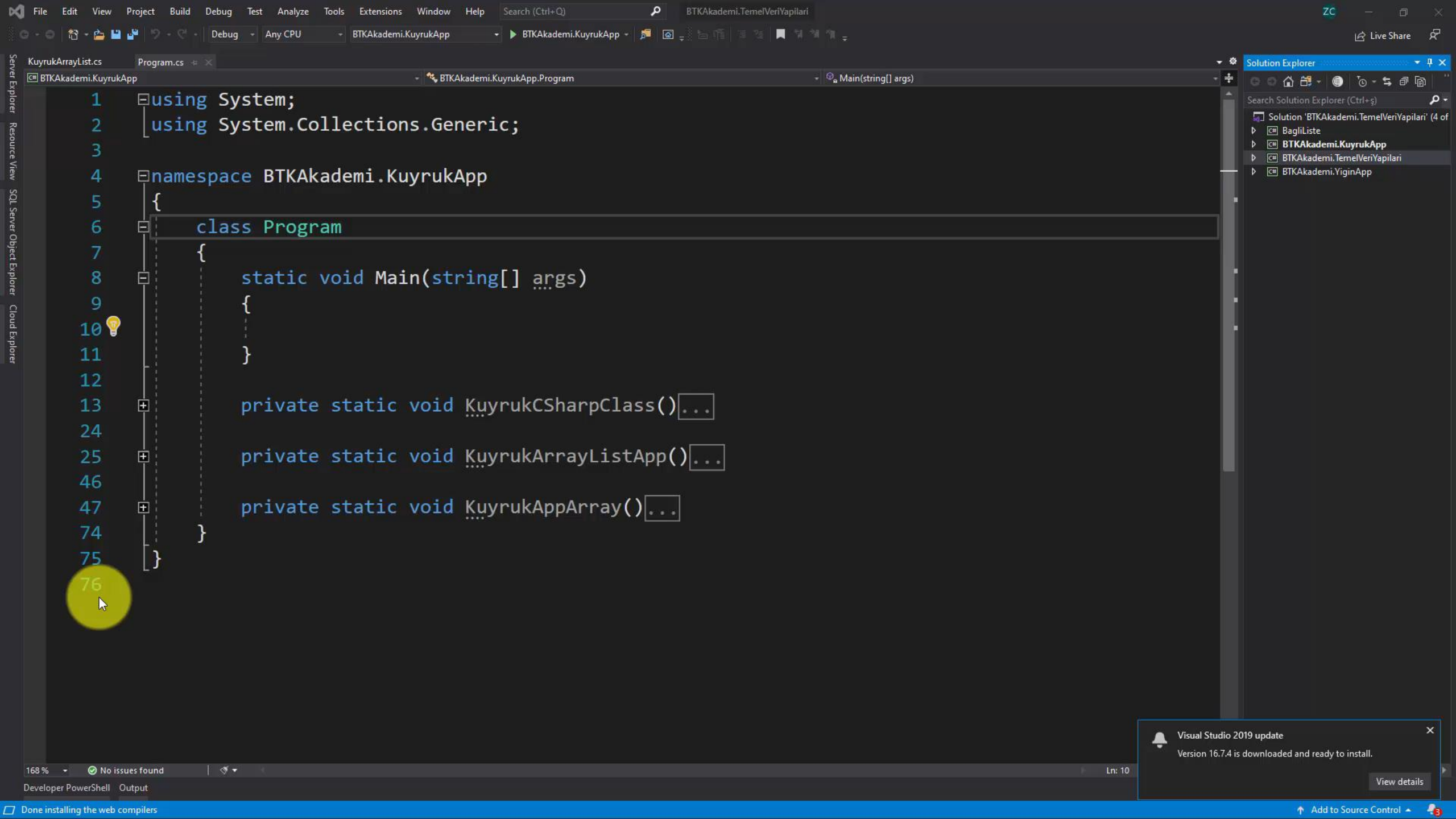
Ağaç

- Ağaç veri yapısı doğrusal olmayan veri yapılarından biridir ve elemanları **hiyerarşik** bir yapıda organize edildiği bir veri yapısıdır.
- Ağaç yapısı olarak ifade edilmesinin nedeni bir **kök** yapısına onun altında **düğümlere** ve onun altında **yaprak** olarak ifade edilen elemanlara sahip olmasıdır.

Ağaç



7 düğümden oluşan bir ağaç örneği

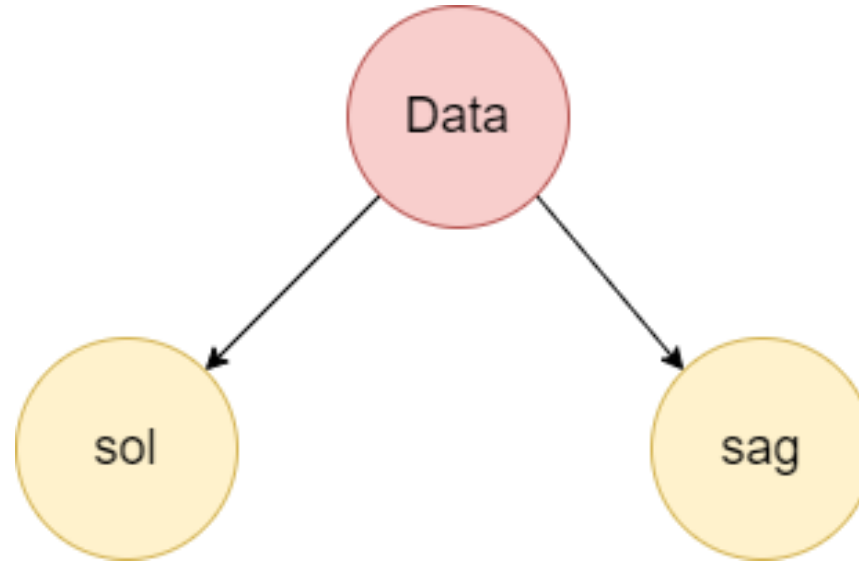


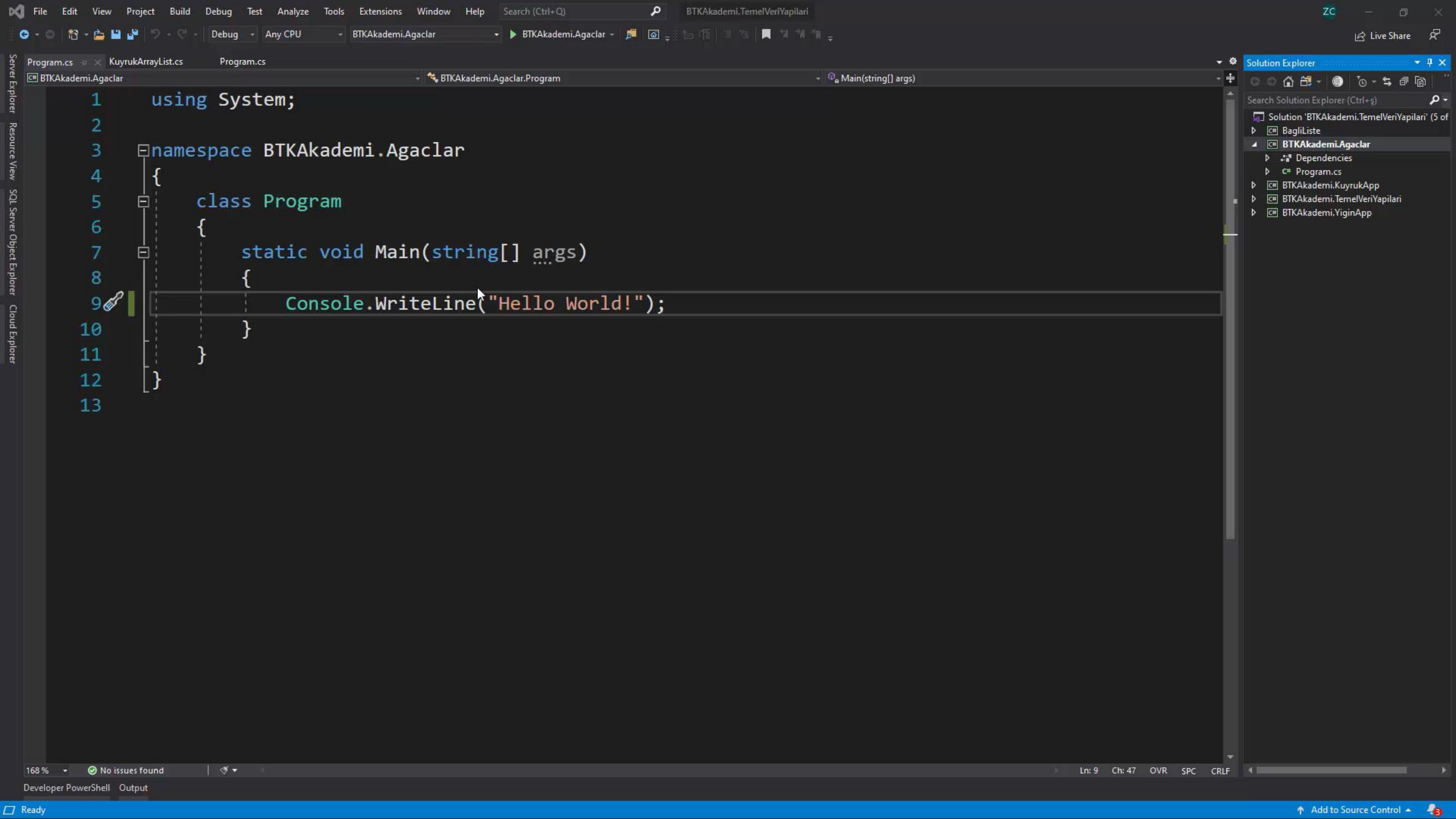
İkili Arama Ağacı

- Özel bir ağaç türüdür.
- Düğümlerin derecesi ikidir.
- Veriler üzerinde farklı dolaşma metotları sunmaktadır.
- Arama işlevi için oldukça kullanışlı ve verimlidir.

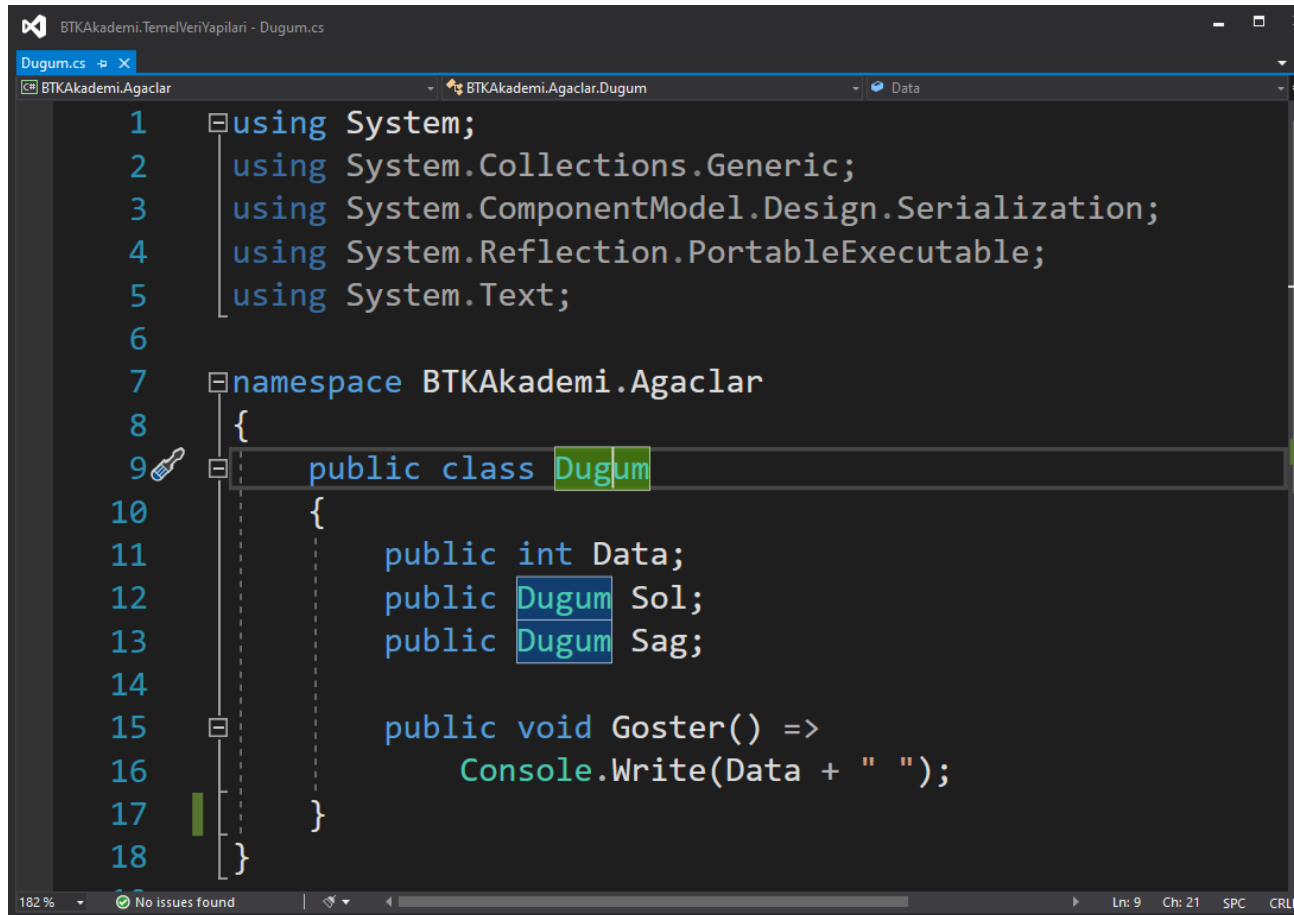
Düğüm Tasarımı

- İkili arama ağacı tasarlarken öncelikle bir düğüm tasarımı gerçekleştiriyoruz.
- İlgili düğüm, veri tutacak bir Data özelliğine sahiptir ve daha sonra sol ve sağ olmak üzere iki işaretçi ile birlikte tasarlanmaktadır.





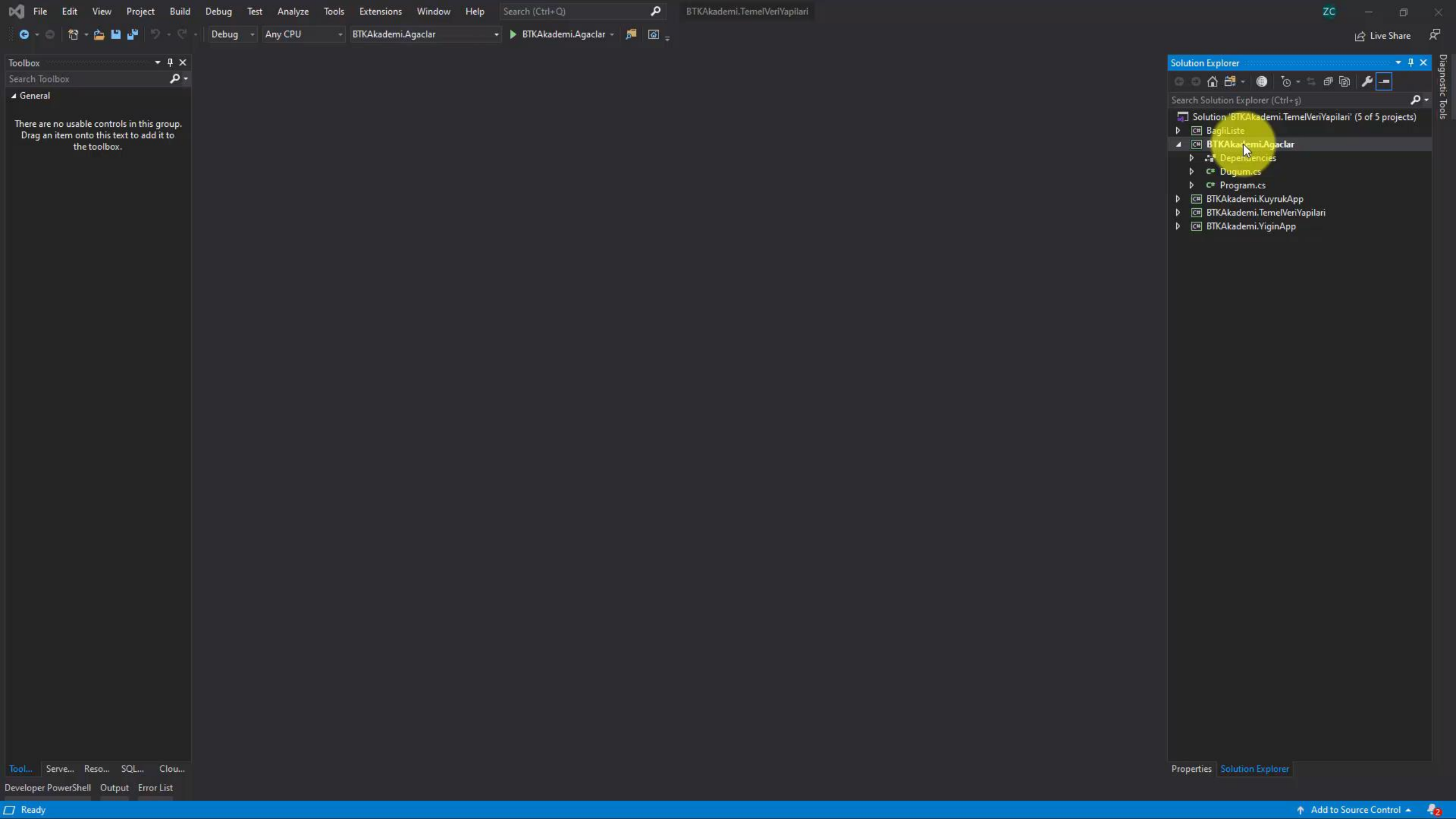
Düğüm Tasarımı



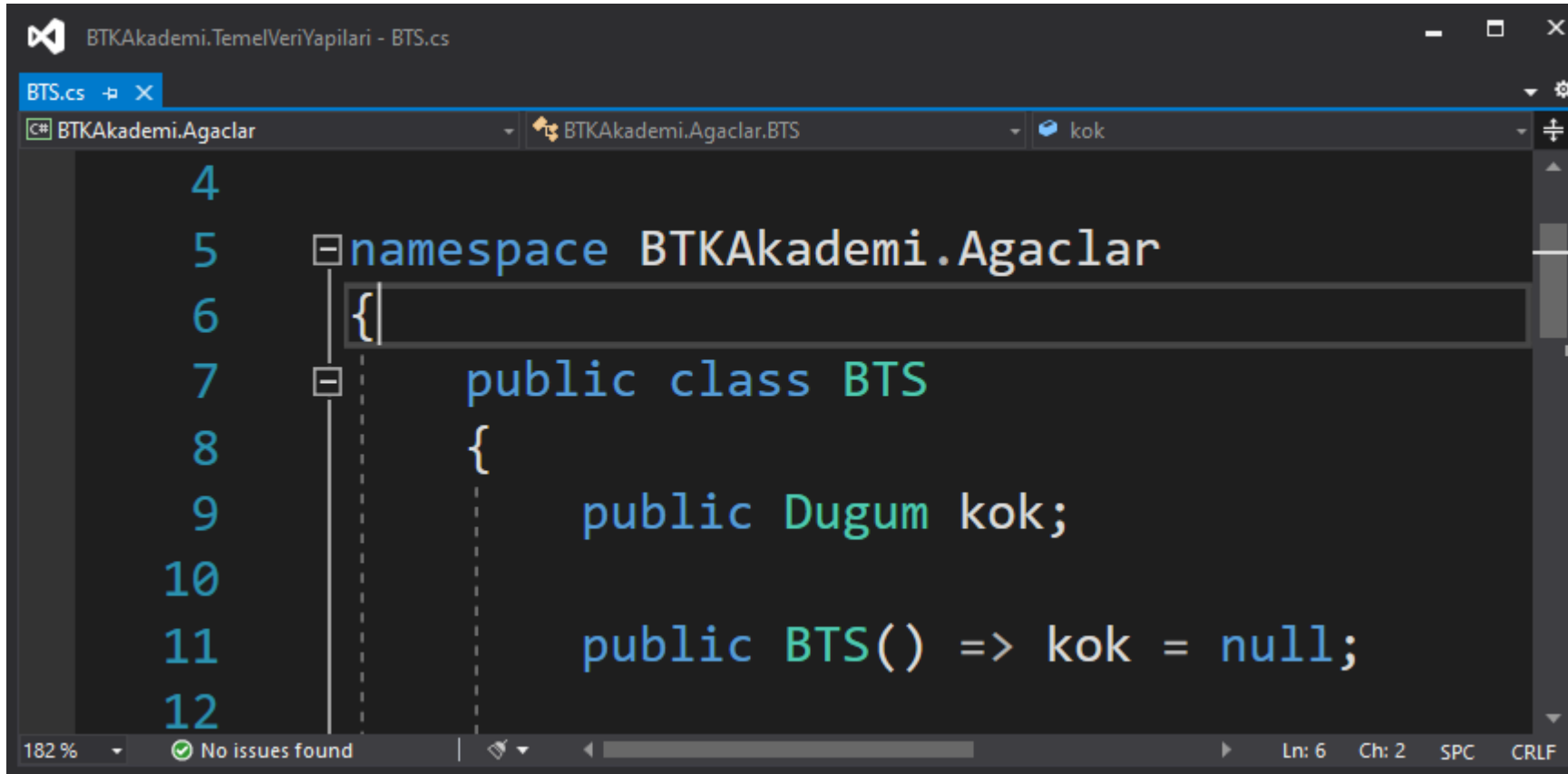
```
1 using System;
2 using System.Collections.Generic;
3 using System.ComponentModel.Design.Serialization;
4 using System.Reflection.PortableExecutable;
5 using System.Text;
6
7 namespace BTKAkademi.Agaclar
8 {
9     public class Dugum
10     {
11         public int Data;
12         public Dugum Sol;
13         public Dugum Sag;
14
15         public void Goster() =>
16             Console.Write(Data + " ");
17     }
18 }
```

Binary Search Tree (BTS)

- İkili arama ağacı üzerindeki yönetimsel fonksiyonları gerçekleştirmek üzere BTS sınıf tasarımını gerçekleştiriyoruz.
- Söz konusu sınıf ile ağaca ekleme yapma, ağaç üzerinde dolaşma, ağaç üzerindeki minimum ve maksimum değerleri bulma gibi yönetimsel işlevlerin tasarımı gerçekleştiriyoruz.
- Öncelikle BTS içinde **kök düğüm** ve **yapılandırıcı metot tasarımı** gerçekleştiriyoruz.



Binary Search Tree (BTS)



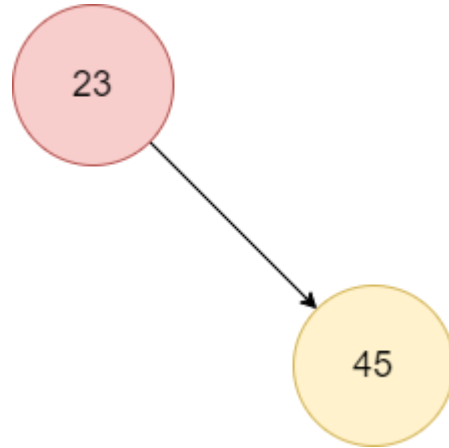
```
4
5 namespace BTKAkademi.Agaclar
6 {
7     public class BTS
8     {
9         public Dugum kok;
10
11         public BTS() => kok = null;
12     }
13 }
```

182 % | No issues found | Ln: 6 Ch: 2 SPC CRLF

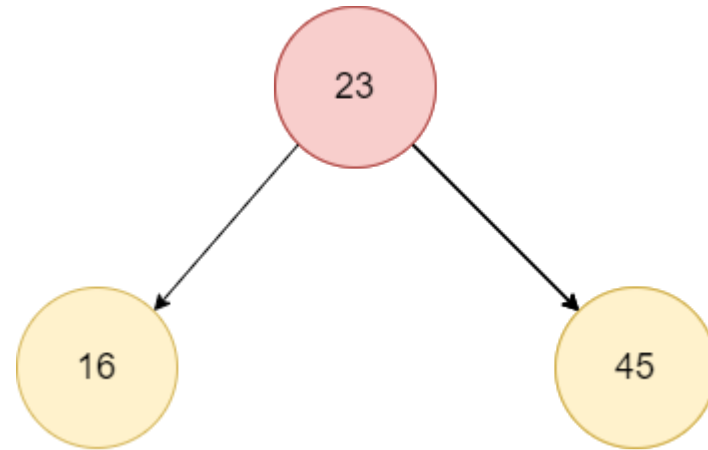
BTS Ekleme

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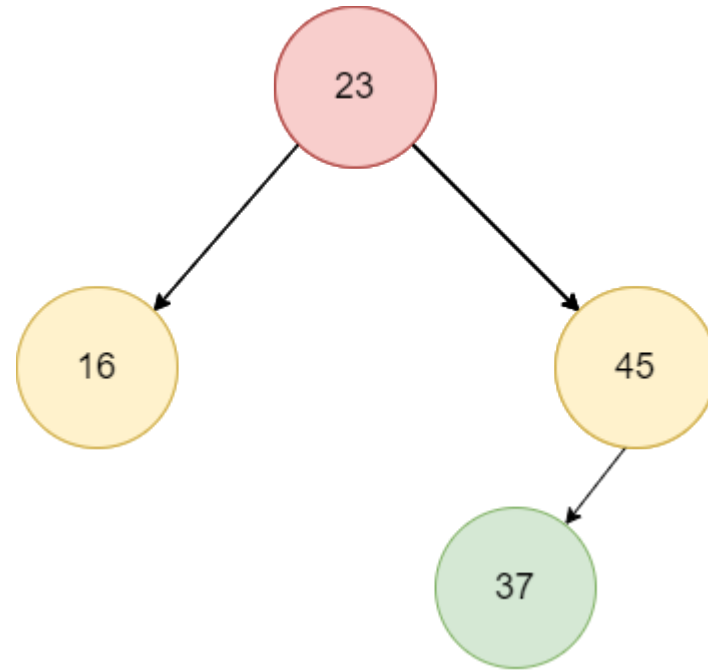
BTS Ekleme



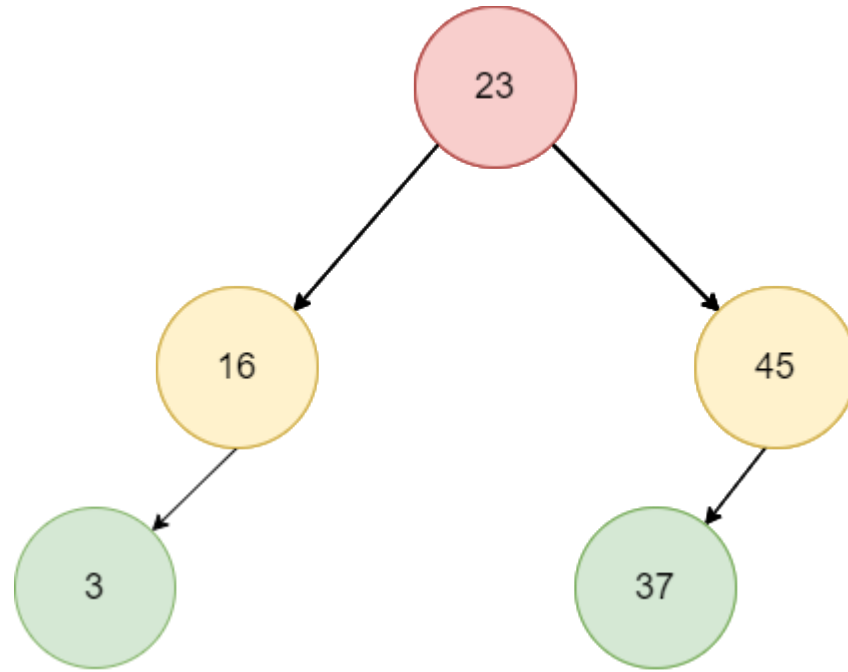
BTS Ekleme



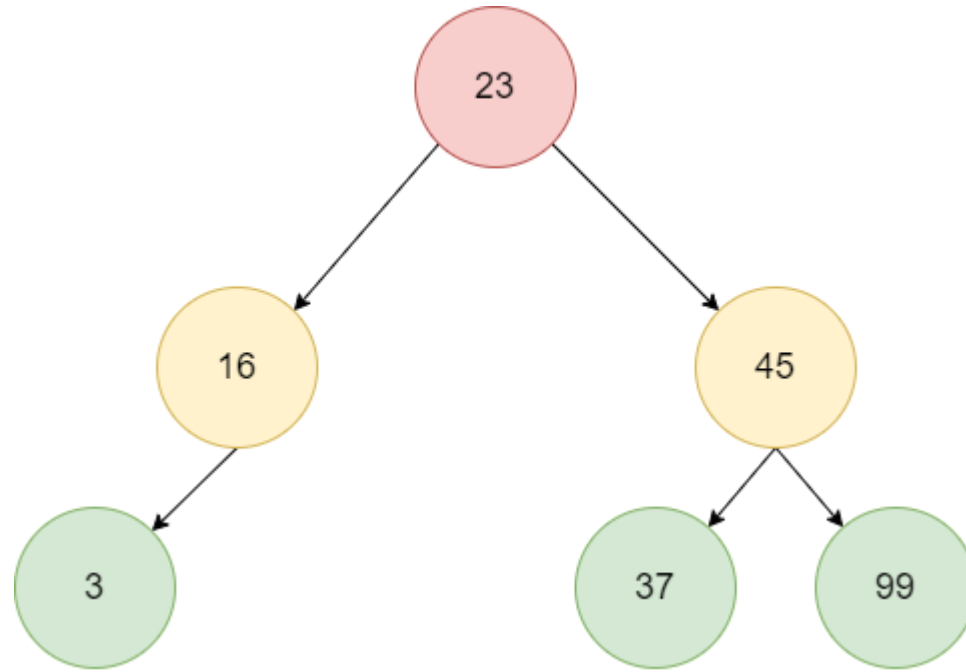
BTS Ekleme



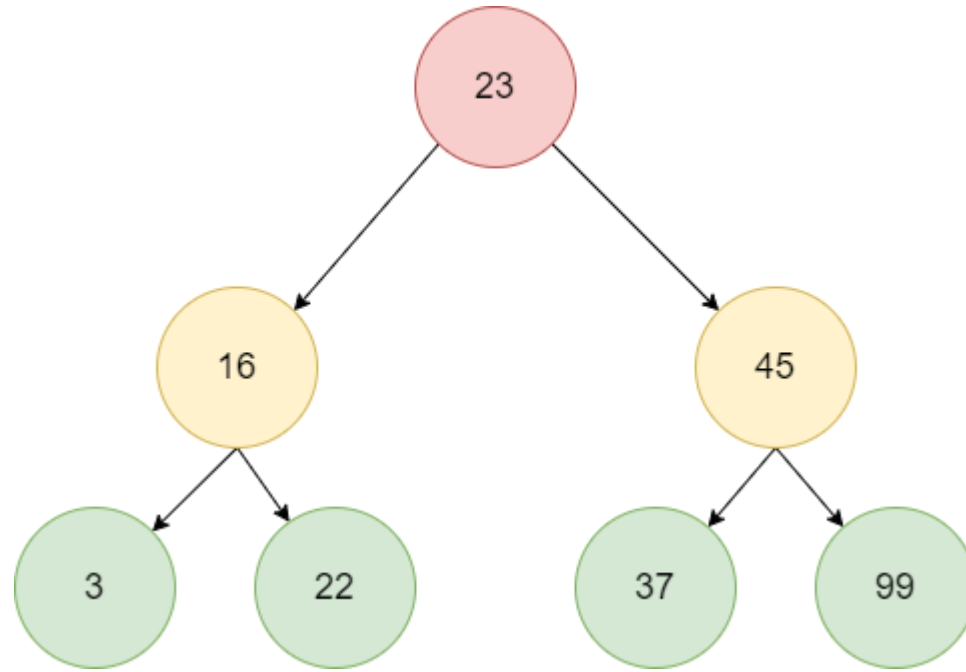
BTS Ekleme

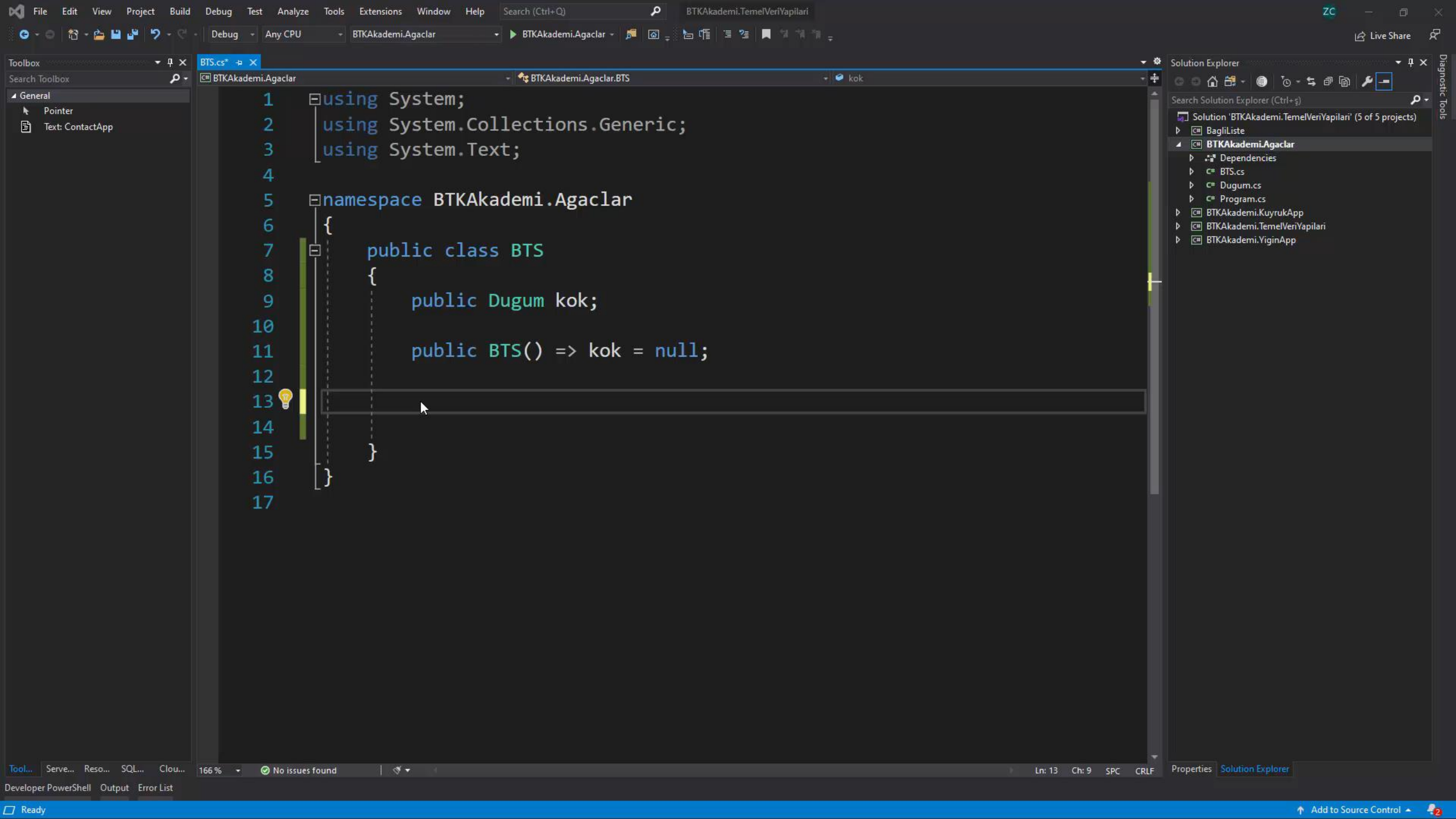


BTS Ekleme

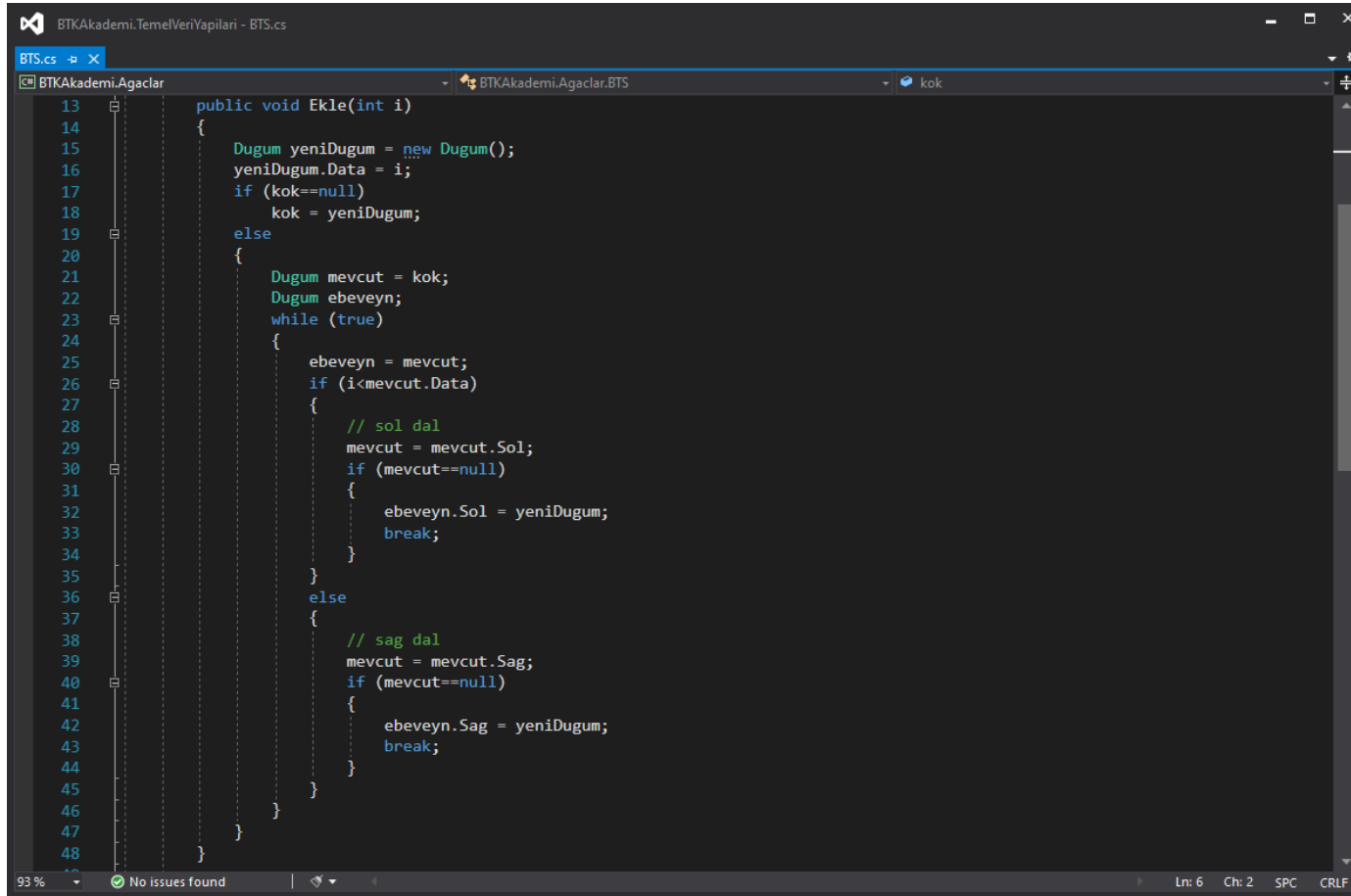


BTS Ekleme





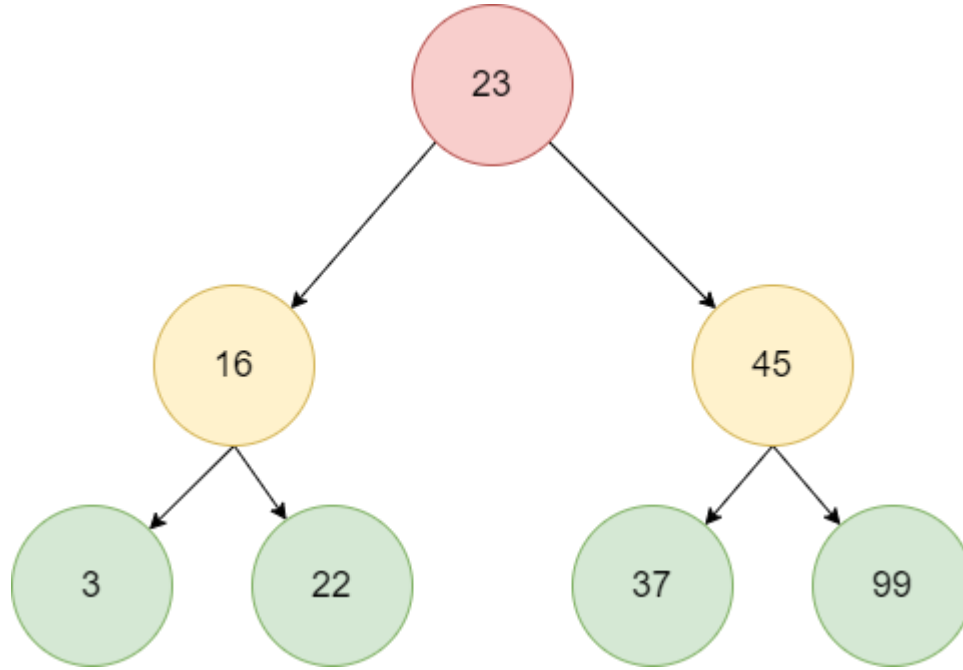
BTS Ekleme



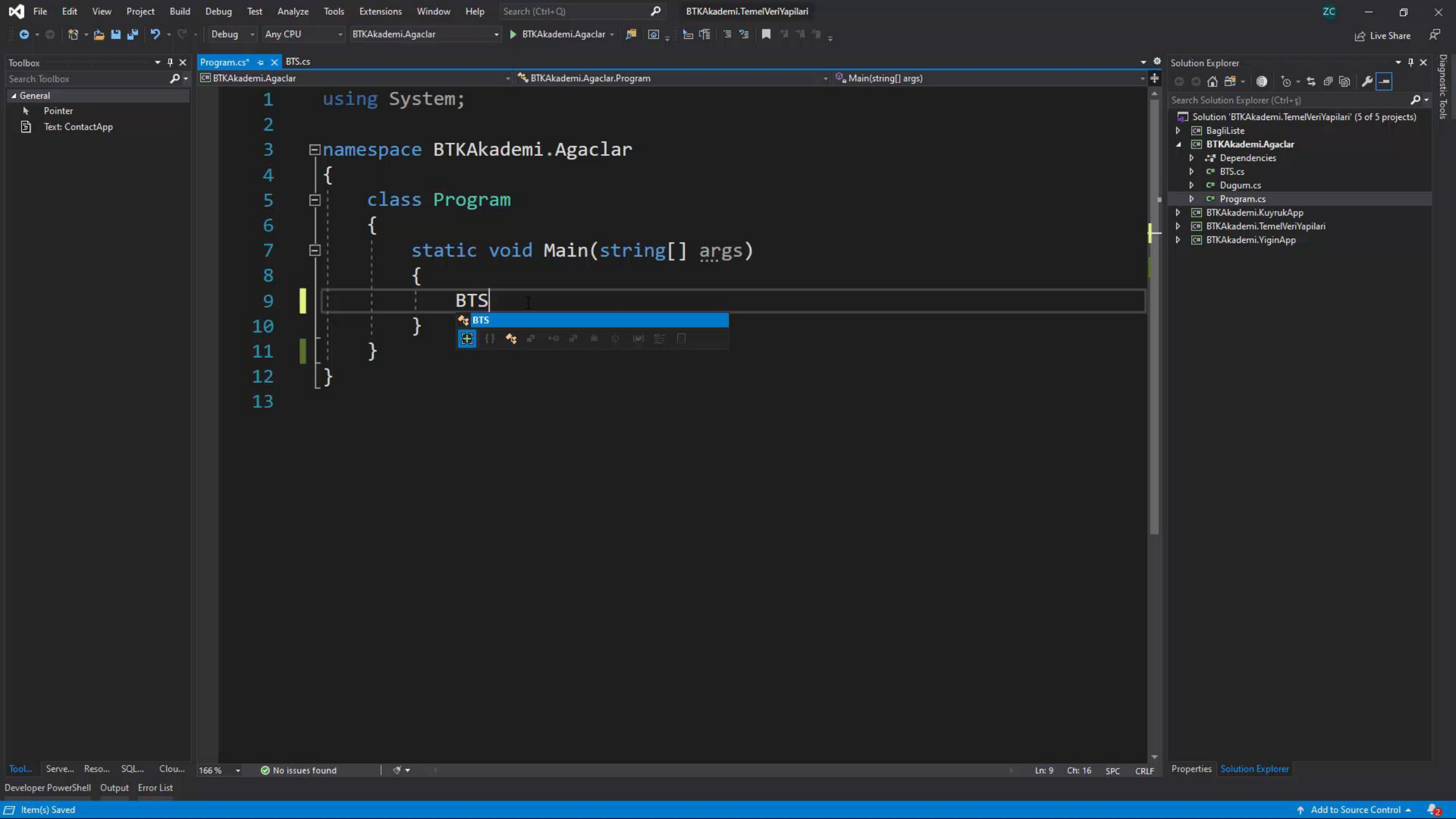
```
13 public void Ekle(int i)
14 {
15     Dugum yeniDugum = new Dugum();
16     yeniDugum.Data = i;
17     if (kok==null)
18         kok = yeniDugum;
19     else
20     {
21         Dugum mevcut = kok;
22         Dugum ebeveyn;
23         while (true)
24         {
25             ebeveyn = mevcut;
26             if (i<mevcut.Data)
27             {
28                 // sol dal
29                 mevcut = mevcut.Sol;
30                 if (mevcut==null)
31                 {
32                     ebeveyn.Sol = yeniDugum;
33                     break;
34                 }
35             }
36             else
37             {
38                 // sag dal
39                 mevcut = mevcut.Sag;
40                 if (mevcut==null)
41                 {
42                     ebeveyn.Sag = yeniDugum;
43                     break;
44                 }
45             }
46         }
47     }
48 }
```

93 % No issues found Ln: 6 Ch: 2 SPC CRLF

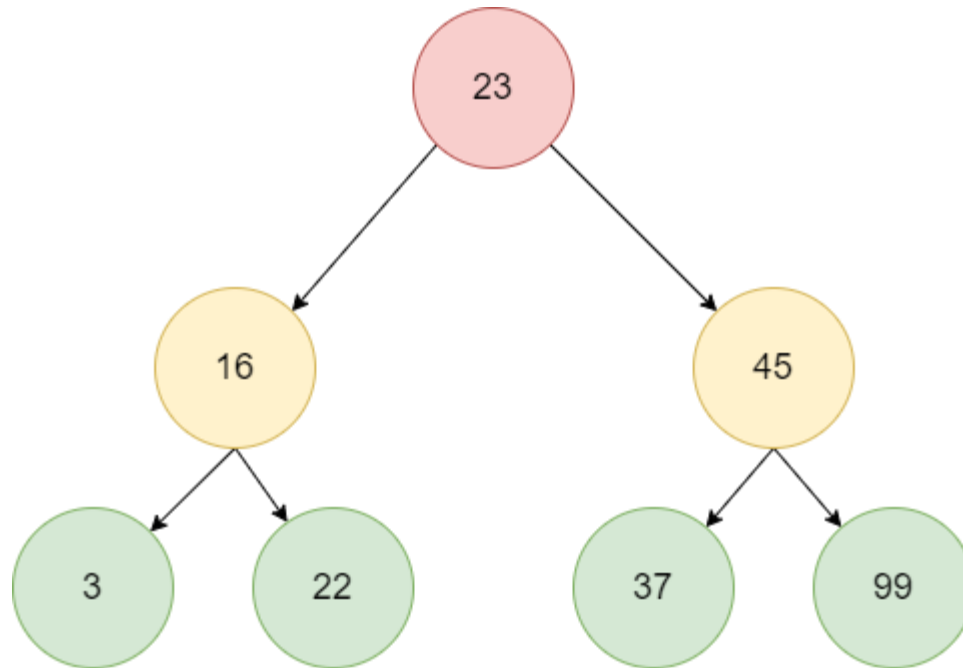
BTS Ekleme



Konsol uygulaması ile devam edelim.



Inorder Dolaşma



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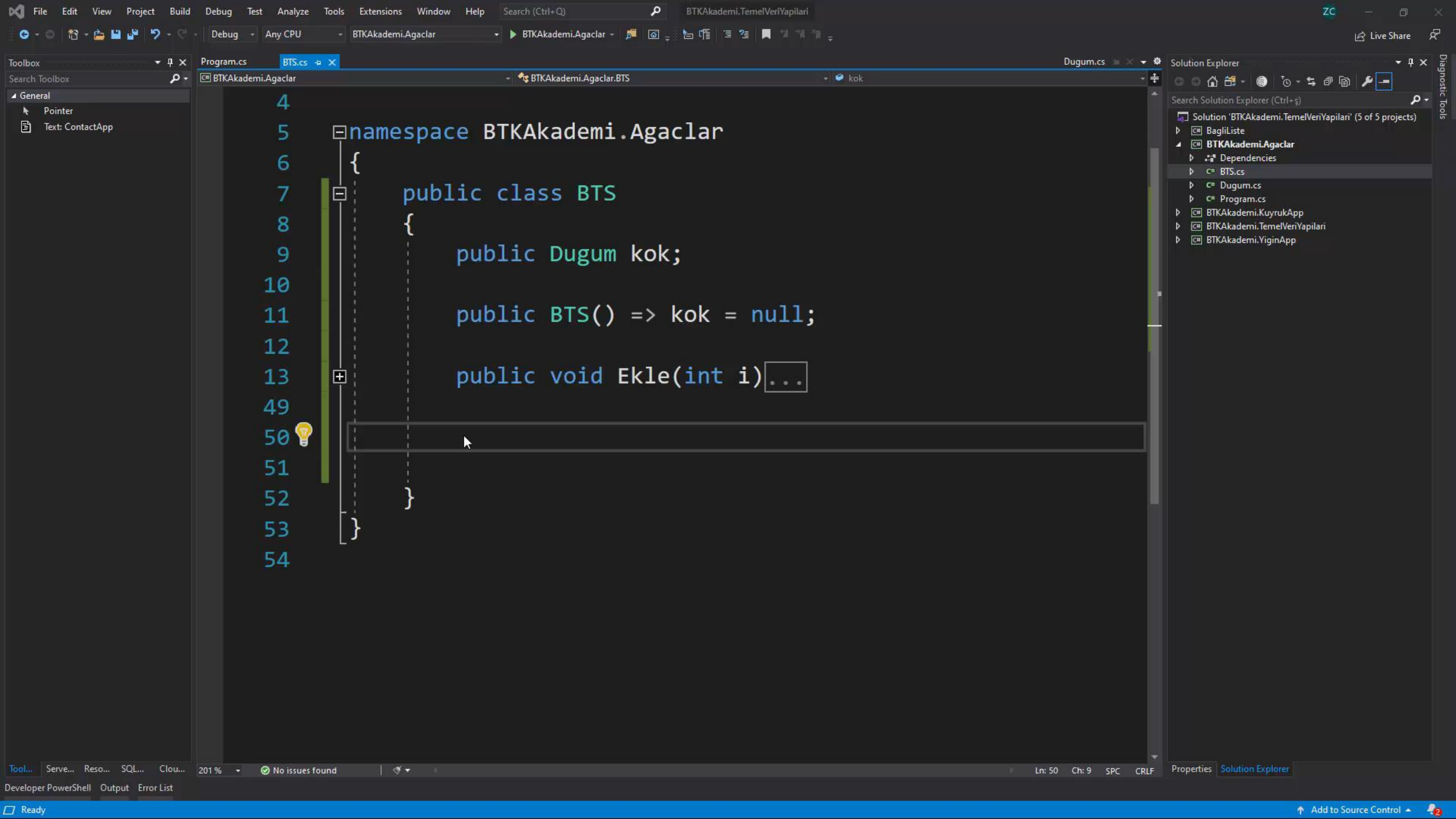
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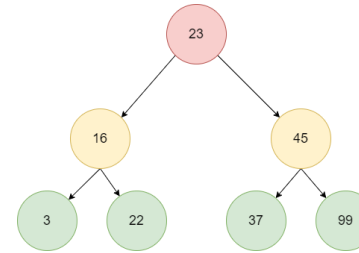
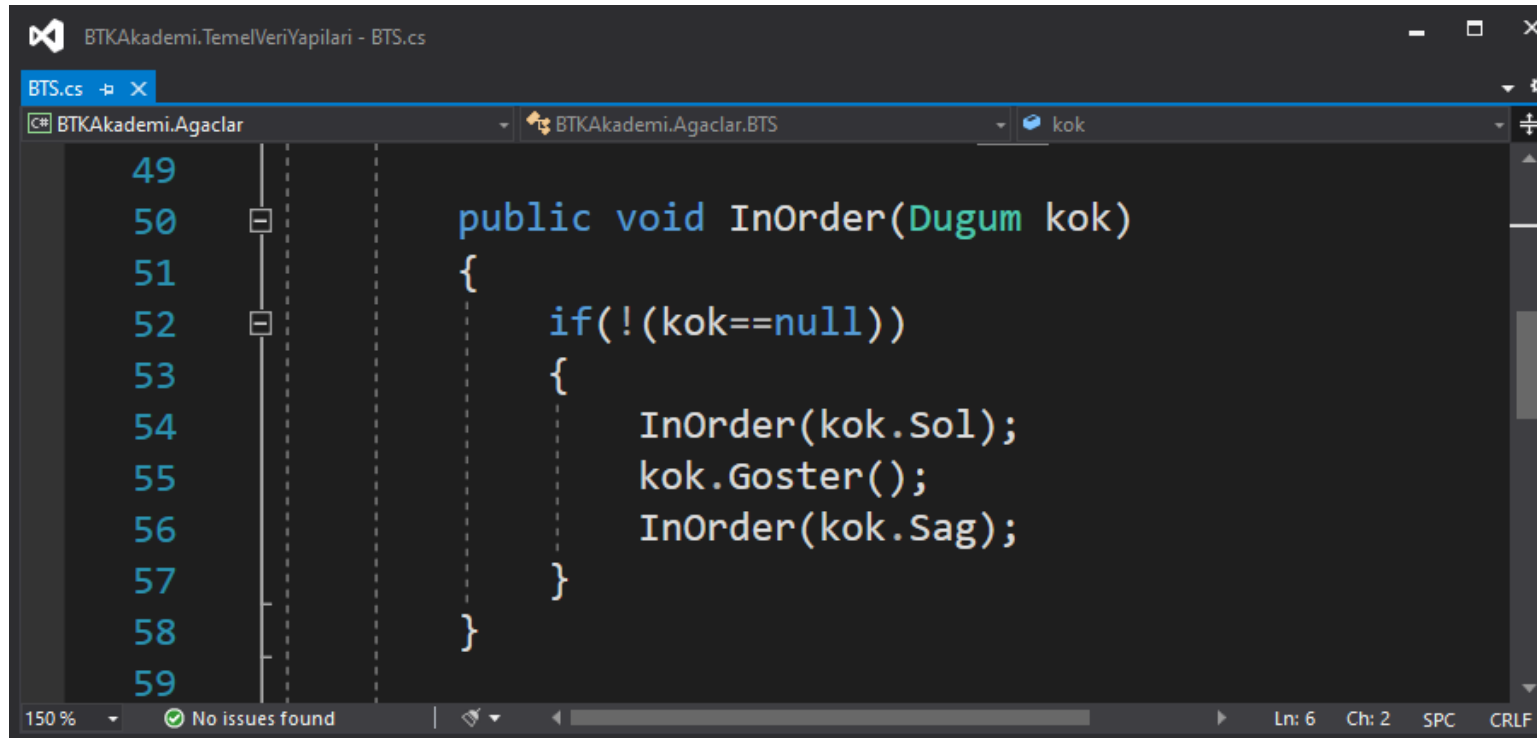
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Inorder Dolaşma

```

BTKAkademi.TemelVeriYapilari - BTS.cs
BTS.cs
BTKAkademi.Agaclar
BTKAkademi.Agaclar.BTS
kok

49
50 public void InOrder(Dugum kok)
51 {
52     if(!(kok==null))
53     {
54         InOrder(kok.Sol);
55         kok.Goster();
56         InOrder(kok.Sag);
57     }
58 }
59

150 % No issues found Ln: 6 Ch: 2 SPC CRLF
  
```

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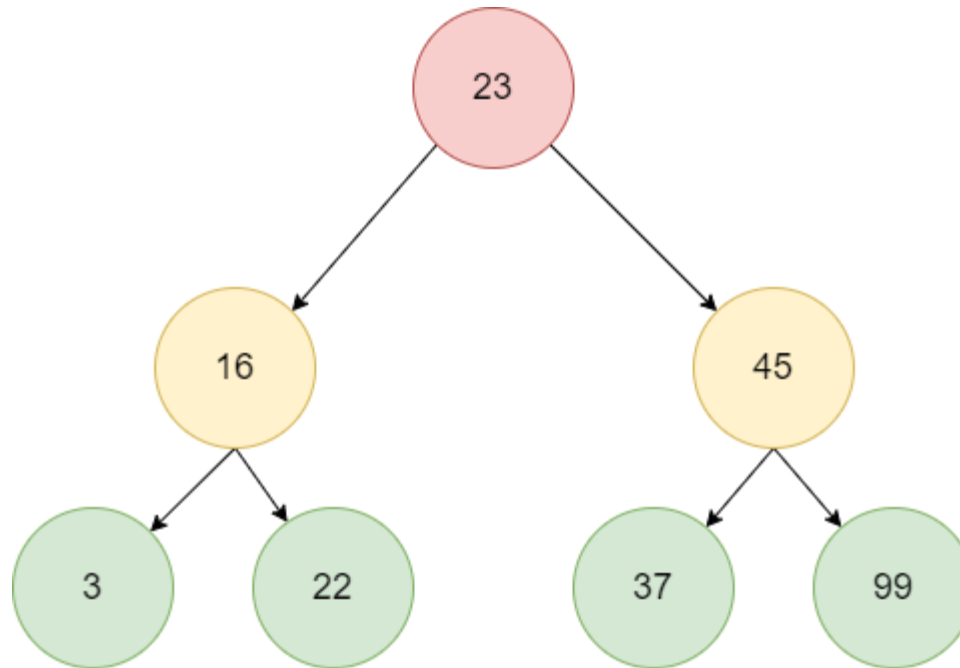
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Preorder Dolaşma



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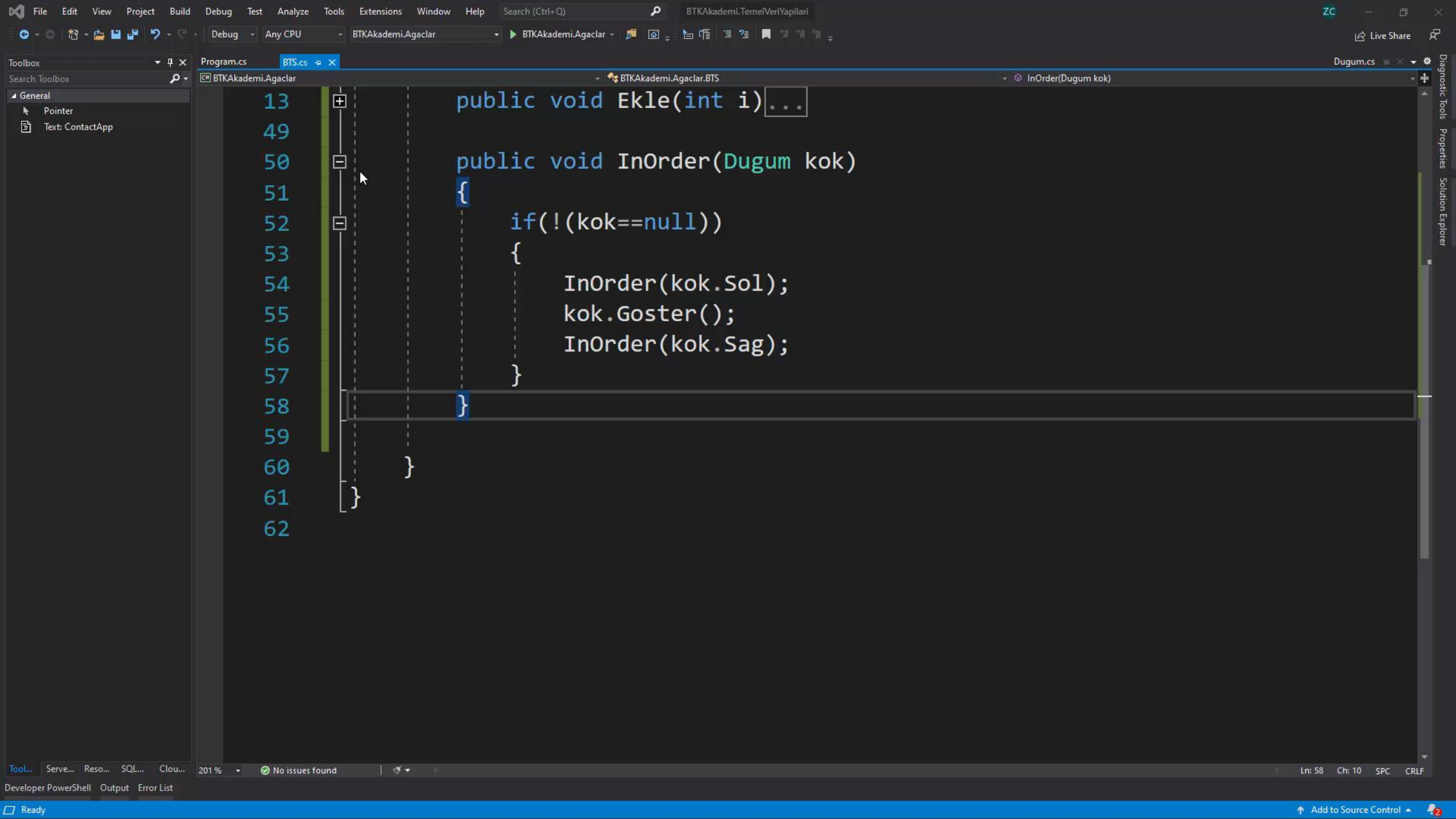
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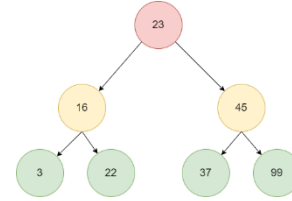
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Preorder Dolaşma



```
BTKAkademi.TemelVeriYapilari - BTS.cs
BTS.cs
BTKAkademi.Agaclar
BTKAkademi.Agaclar.BTS
kok

59
60 public void PreOrder(Dugum kok)
61 {
62     if (!(kok==null))
63     {
64         kok.Goster();
65         PreOrder(kok.Sol);
66         PreOrder(kok.Sag);
67     }
68 }
69

150 % No issues found Ln: 6 Ch: 2 SPC CRLF
```

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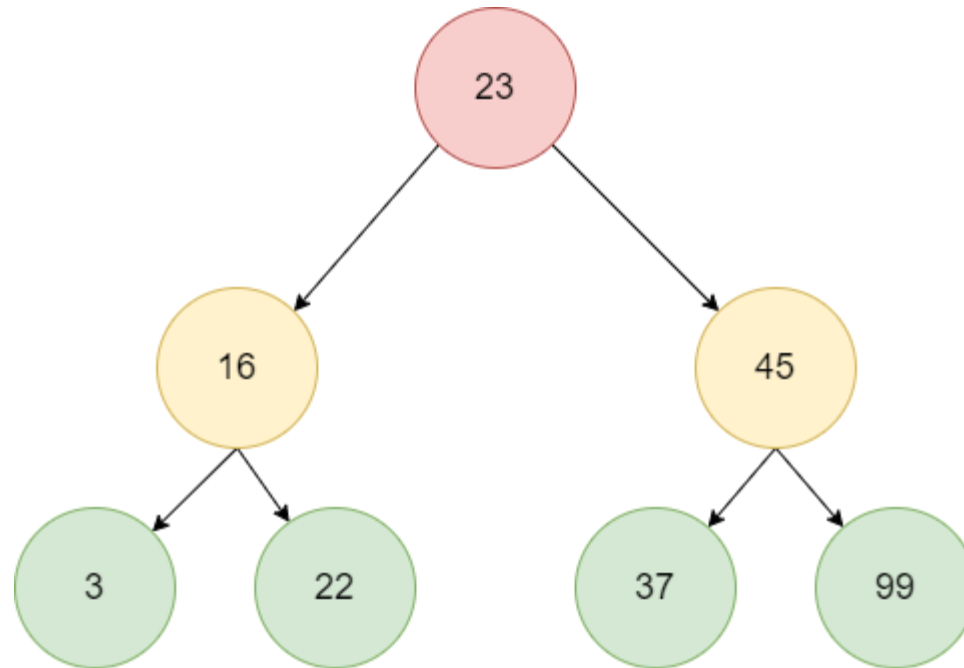
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Postorder Dolaşma



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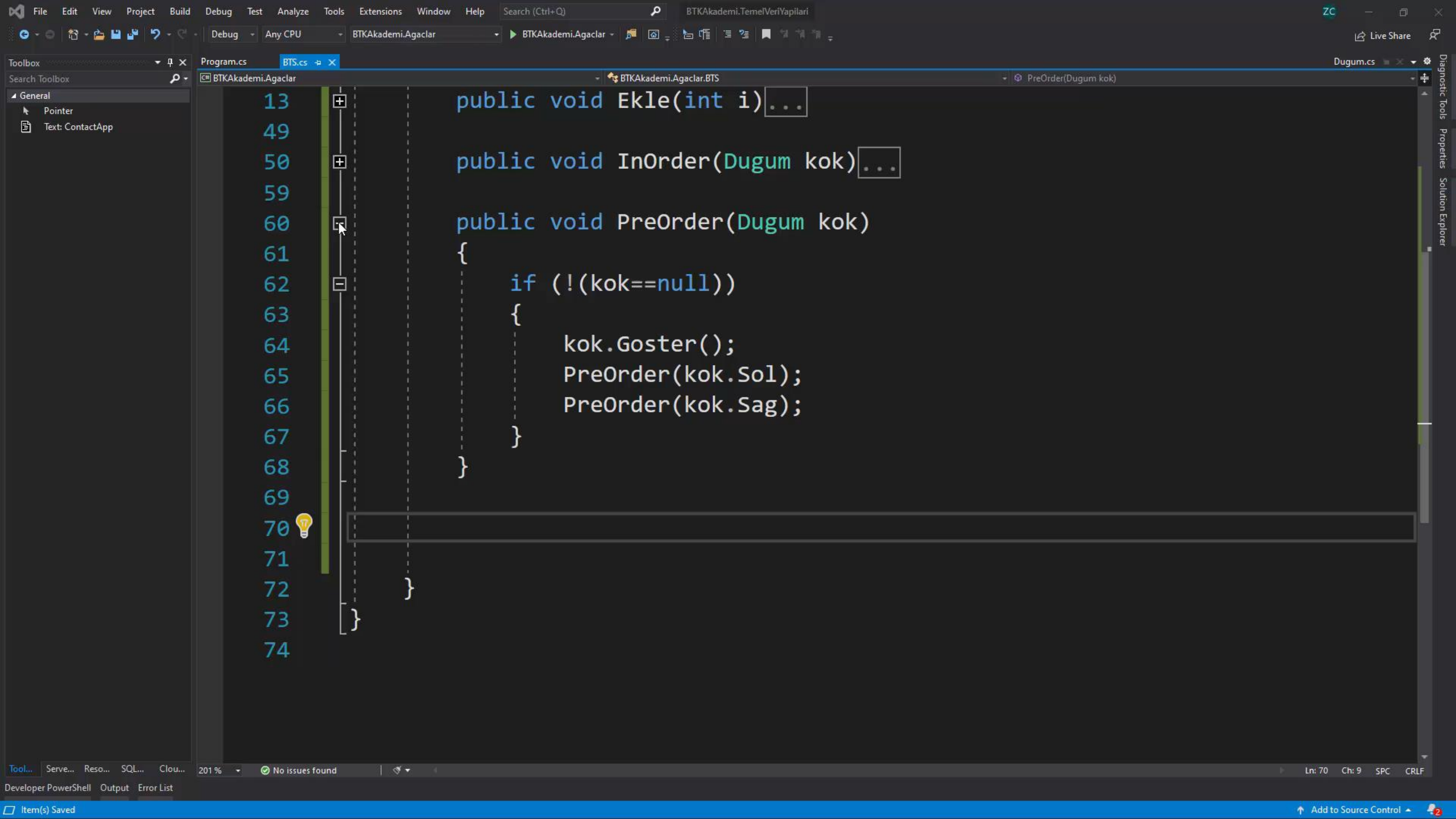
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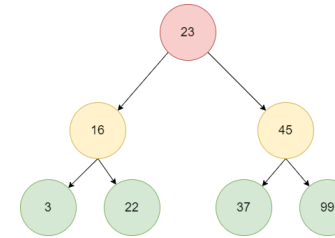
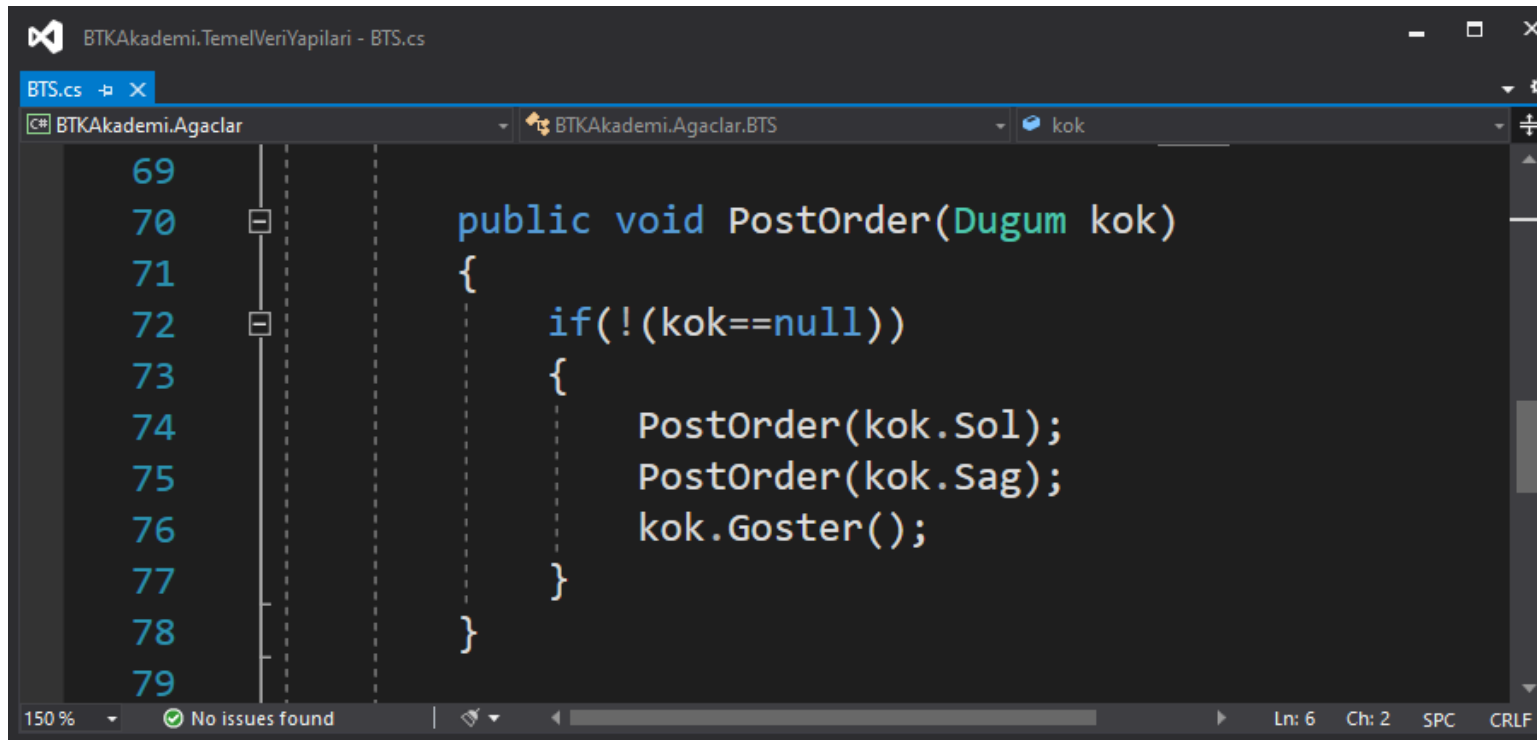
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Postorder Dolaşma

```

BTKAkademi.TemelVeriYapilari - BTS.cs
BTS.cs
BTKAkademi.Agaclar
BTKAkademi.Agaclar.BTS
kok

69
70 public void PostOrder(Dugum kok)
71 {
72     if(!(kok==null))
73     {
74         PostOrder(kok.Sol);
75         PostOrder(kok.Sag);
76         kok.Goster();
77     }
78 }
79
150 % No issues found Ln: 6 Ch: 2 SPC CRLF
  
```

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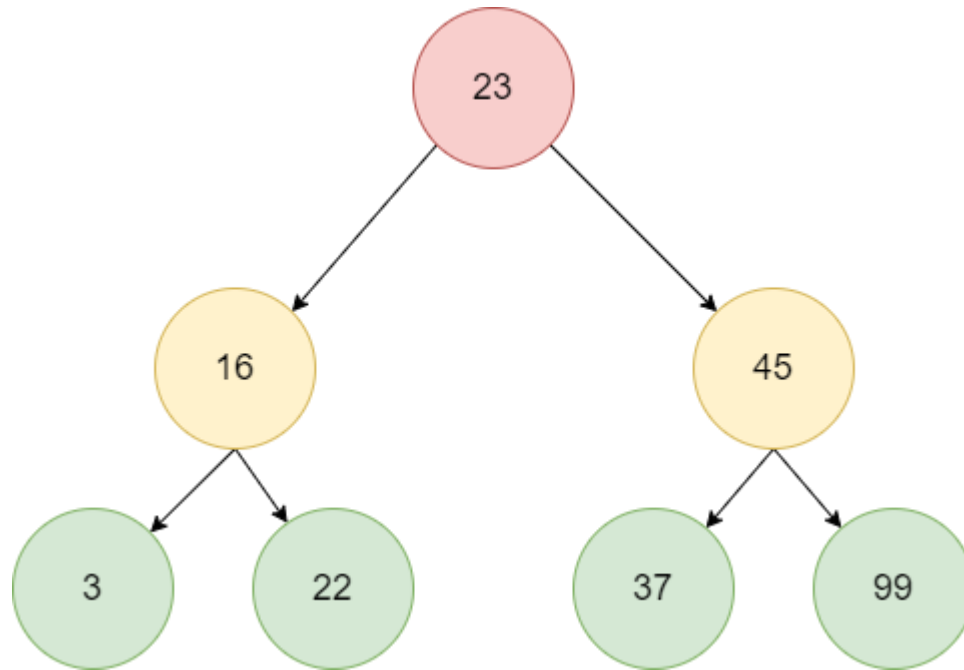
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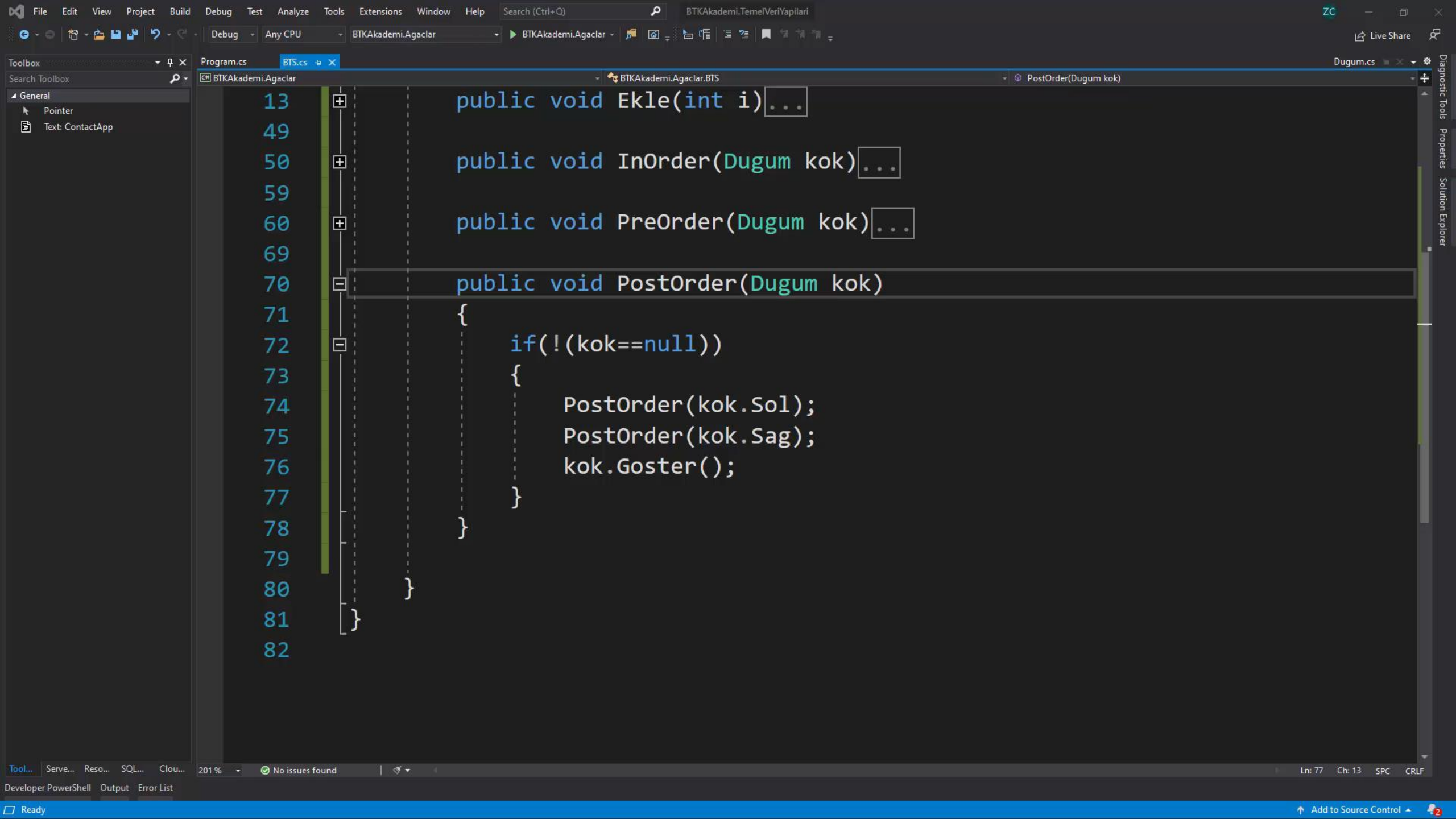
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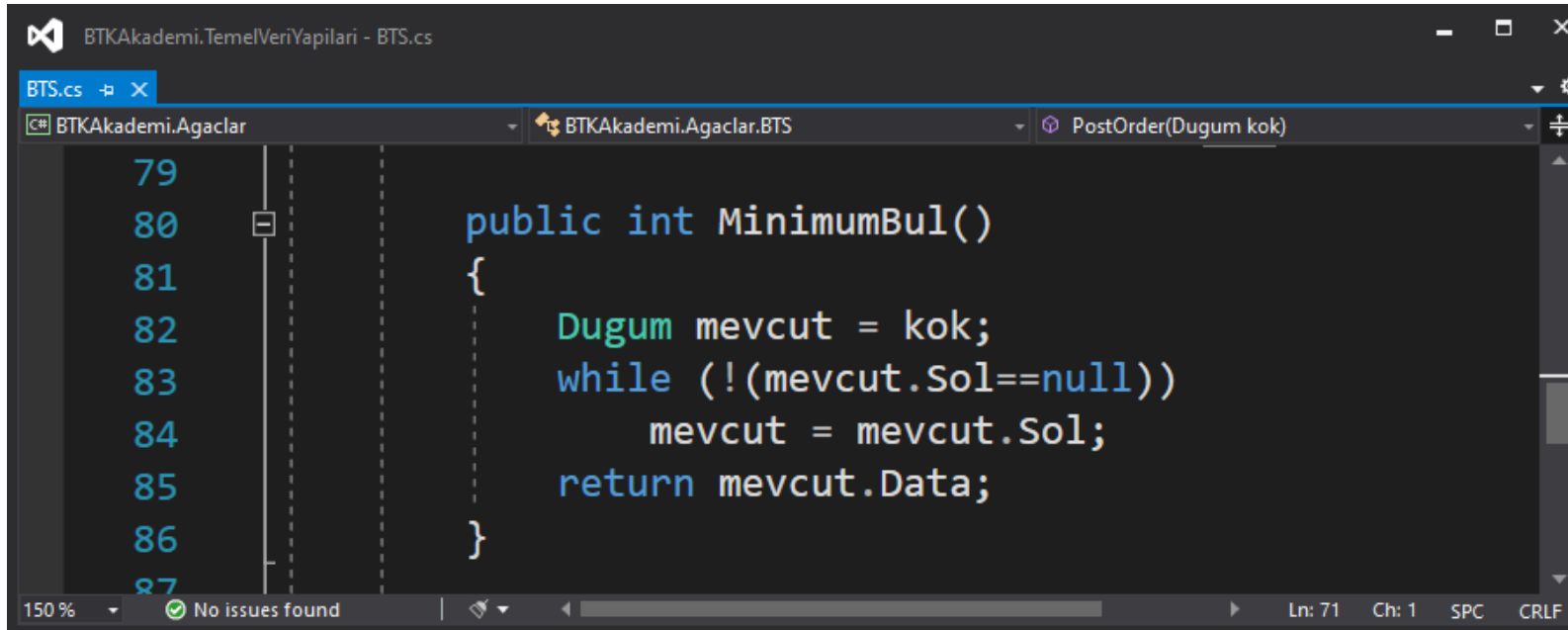
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Minimum değerli elemanı bulma



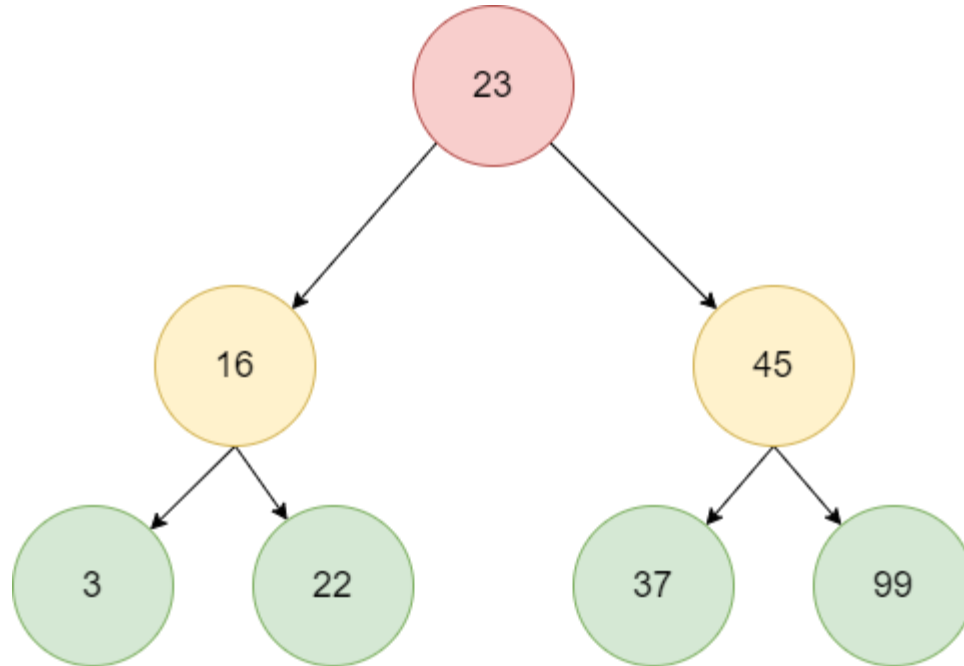


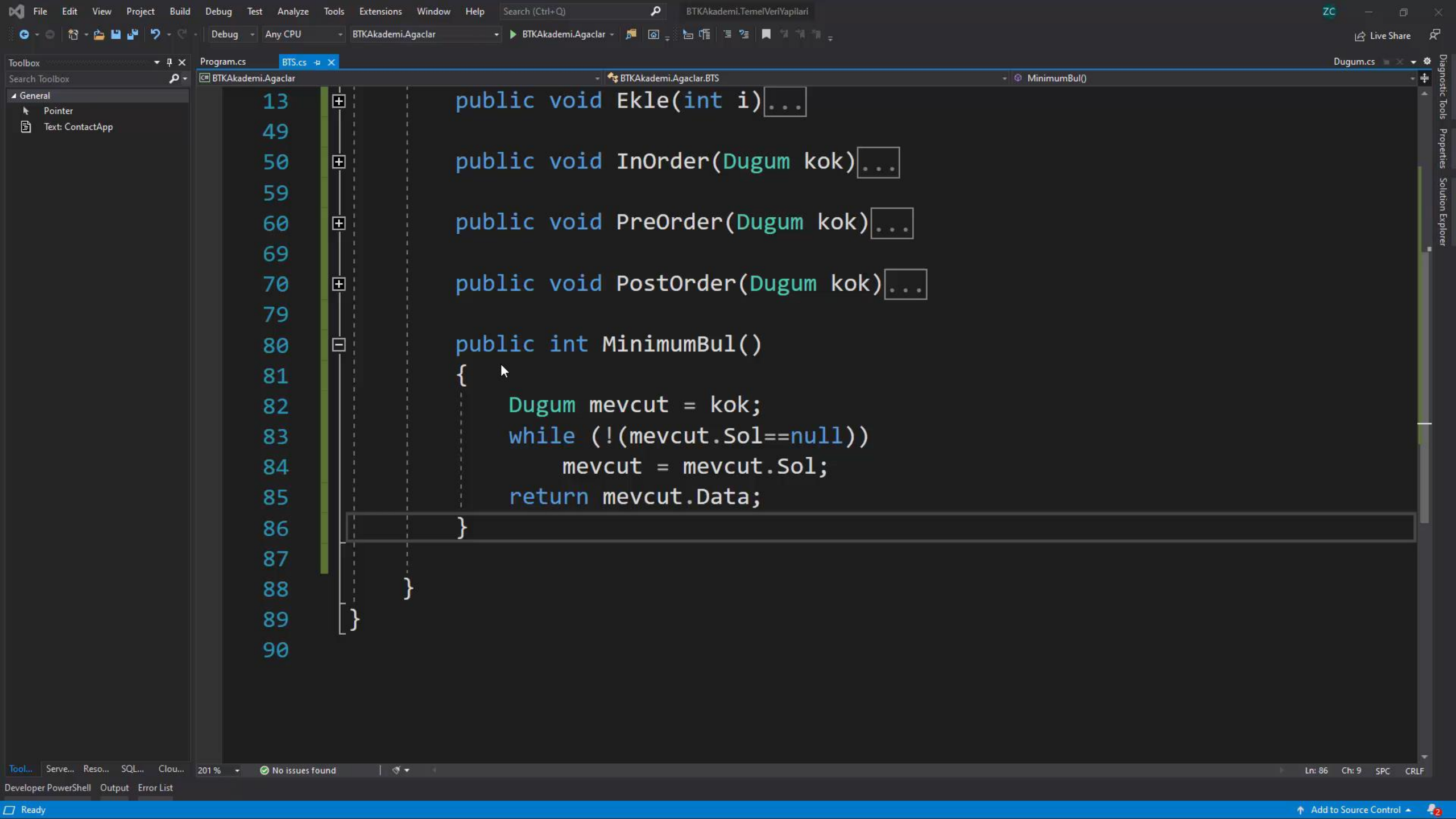
Minimum değerli elemanı bulma



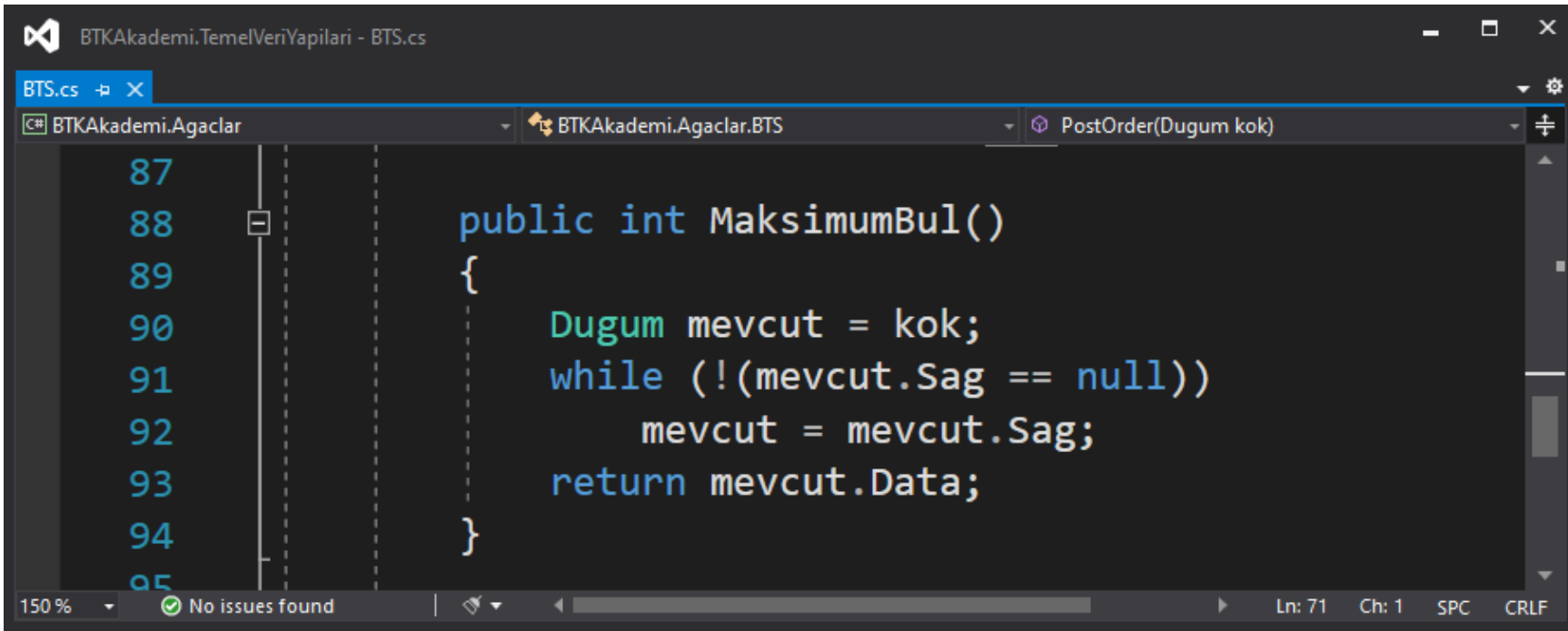
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BTKAkademi.TemelVeriYapilari - BTS.cs
BTS.cs
C# BTKAkademi.Agaclar BTKAkademi.Agaclar.BTS PostOrder(Dugum kok)
79
80 public int MinimumBul()
81 {
82     Dugum mevcut = kok;
83     while (!(mevcut.Sol==null))
84         mevcut = mevcut.Sol;
85     return mevcut.Data;
86 }
87
150 % No issues found Ln: 71 Ch: 1 SPC CRLF
```

Maksimum değerli elemanı bulma



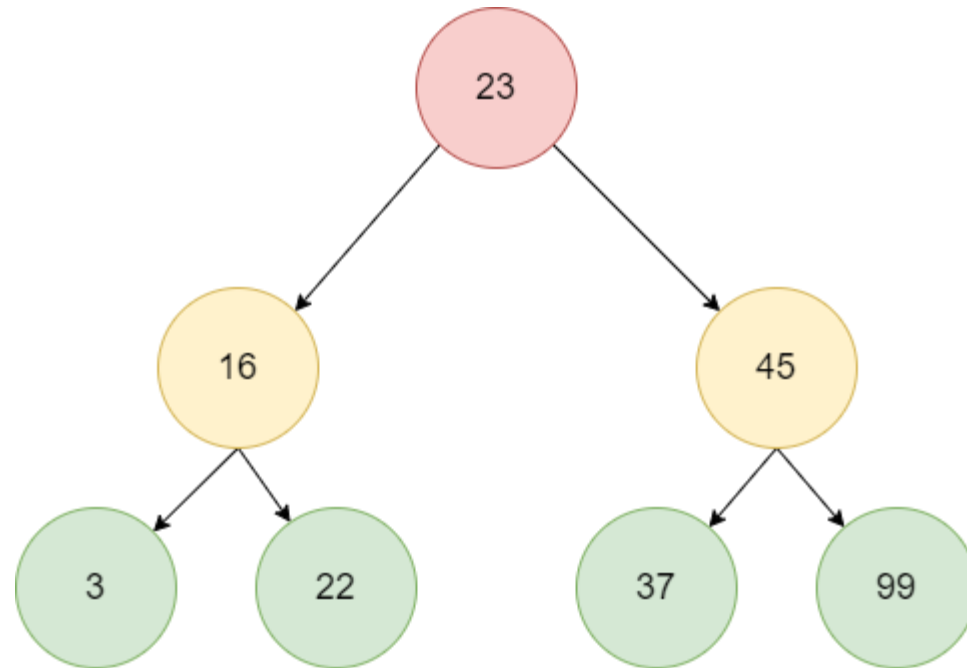


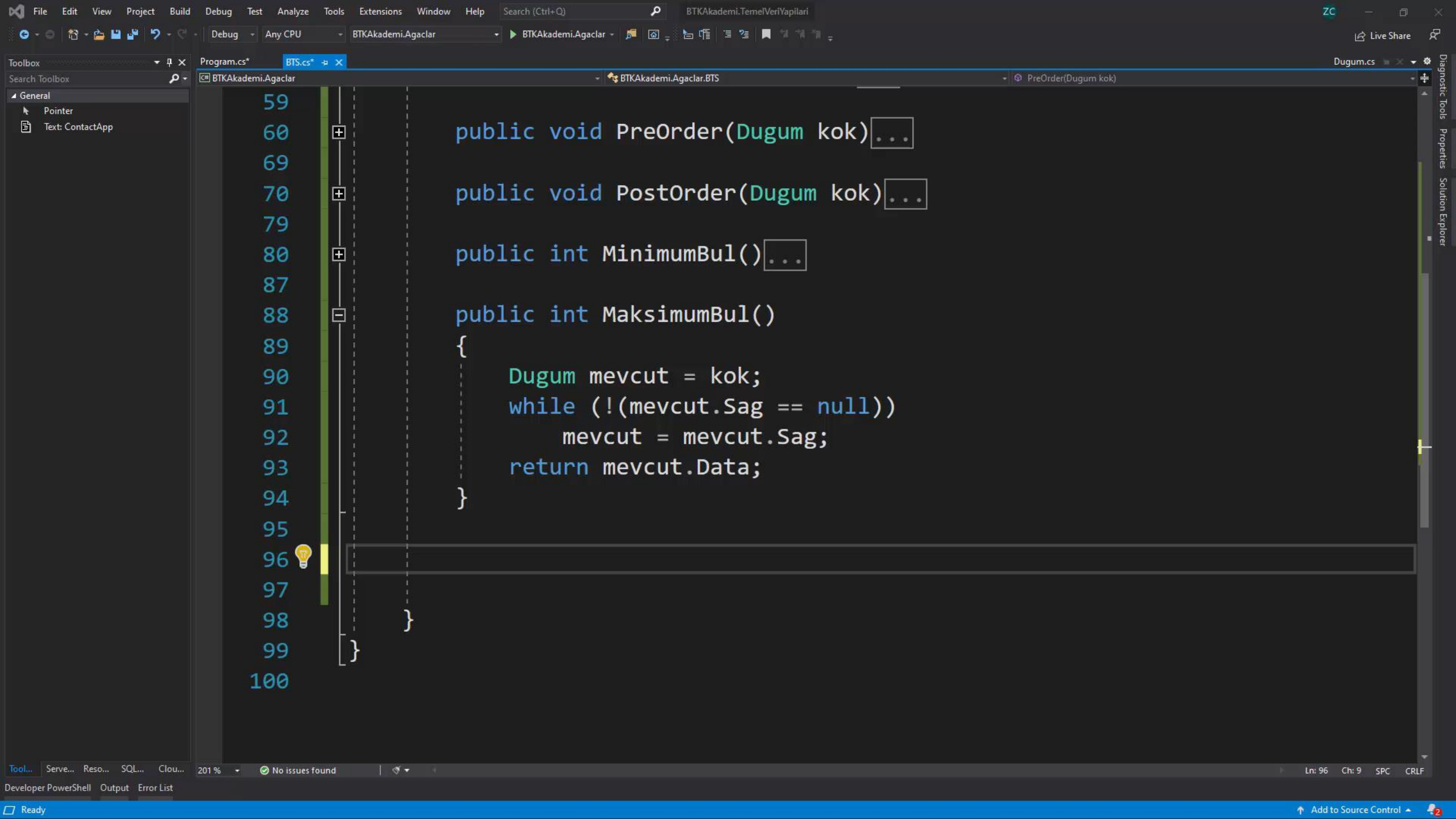
Maksimum değerli elemanı bulma



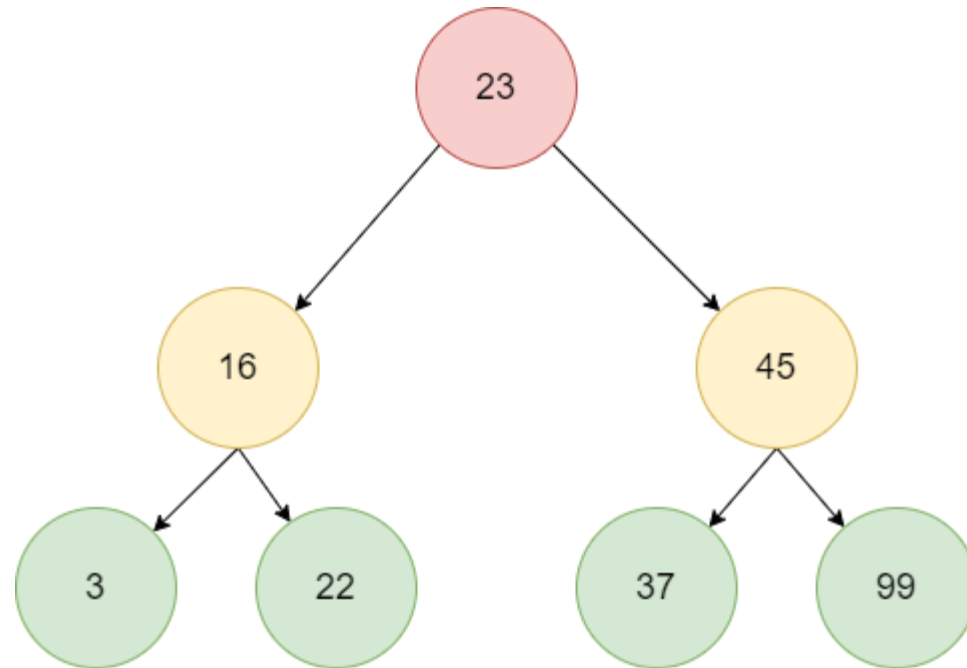
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Bul metodunun tasarlanması

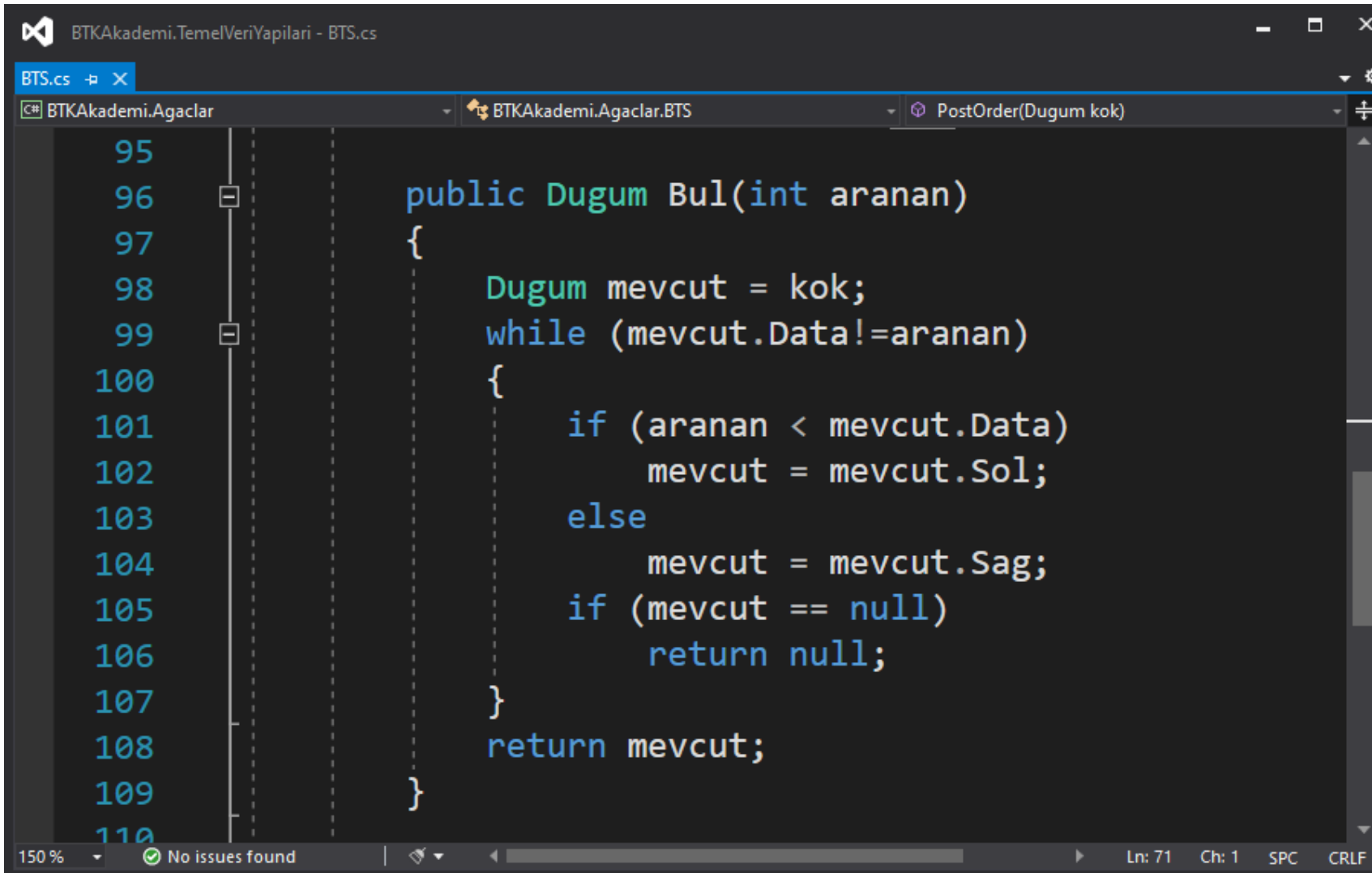




Bul metodunun tasarlanması



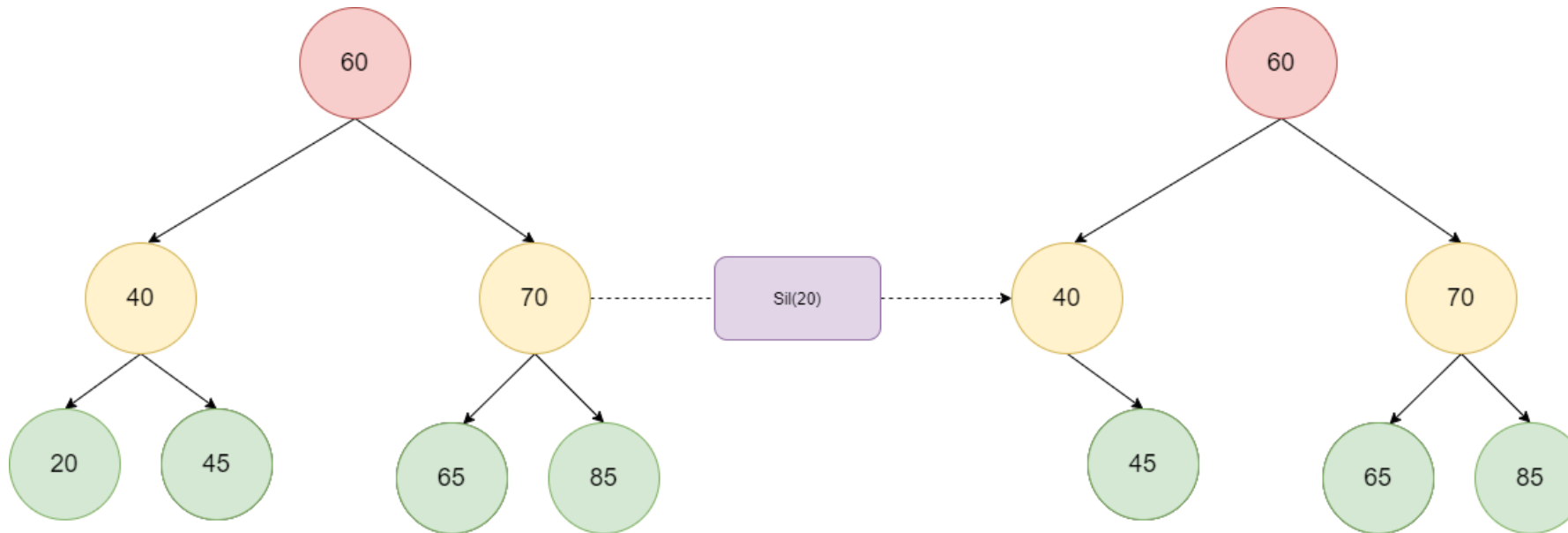
Bul metodunun tasarlanması



```
95
96 public Dugum Bul(int aranan)
97 {
98     Dugum mevcut = kok;
99     while (mevcut.Data != aranan)
100     {
101         if (aranan < mevcut.Data)
102             mevcut = mevcut.Sol;
103         else
104             mevcut = mevcut.Sag;
105         if (mevcut == null)
106             return null;
107     }
108     return mevcut;
109 }
110
```

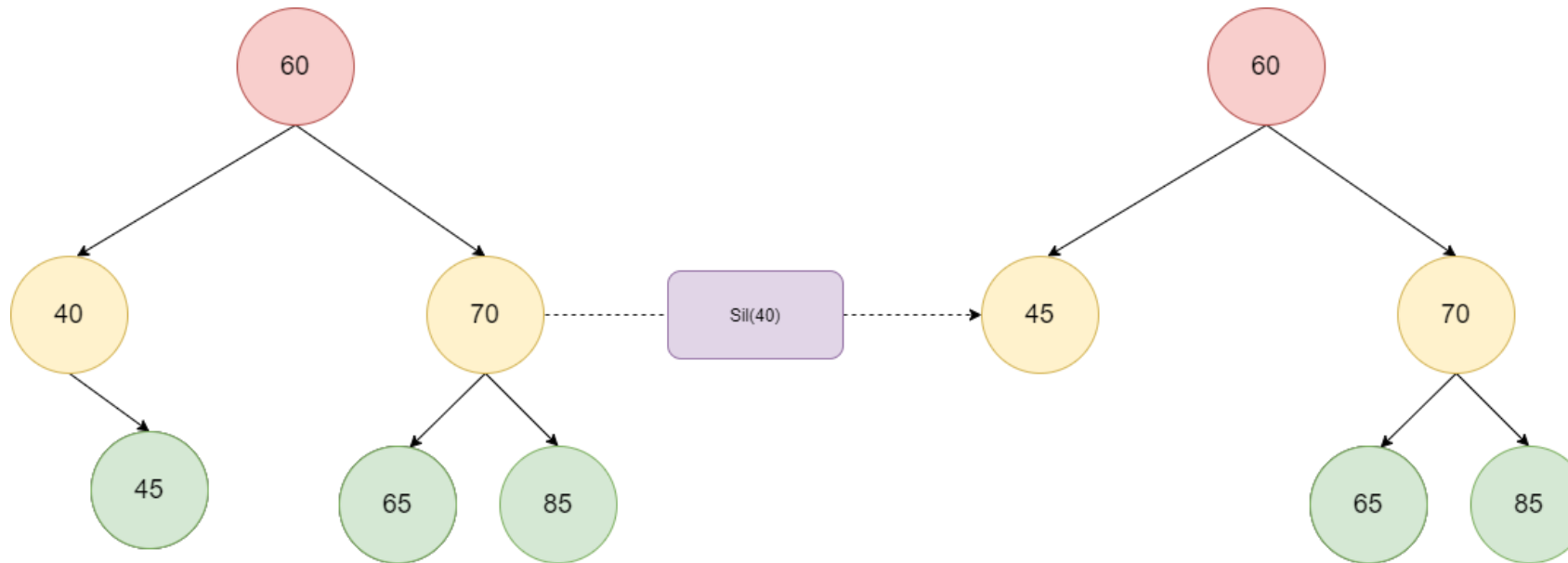
150 % No issues found Ln: 71 Ch: 1 SPC CRLF

Ağaçtan eleman silme



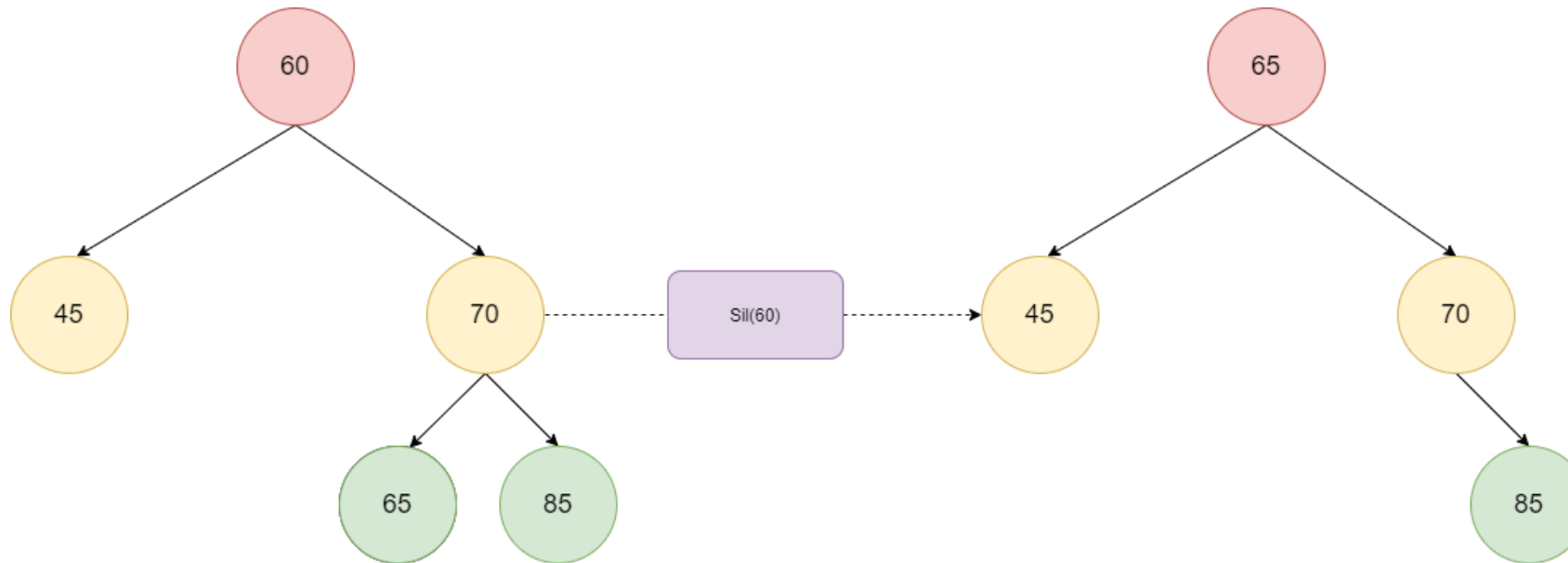
Ağaçtan bir yaprağın silinmesi

Ağaçtan eleman silme

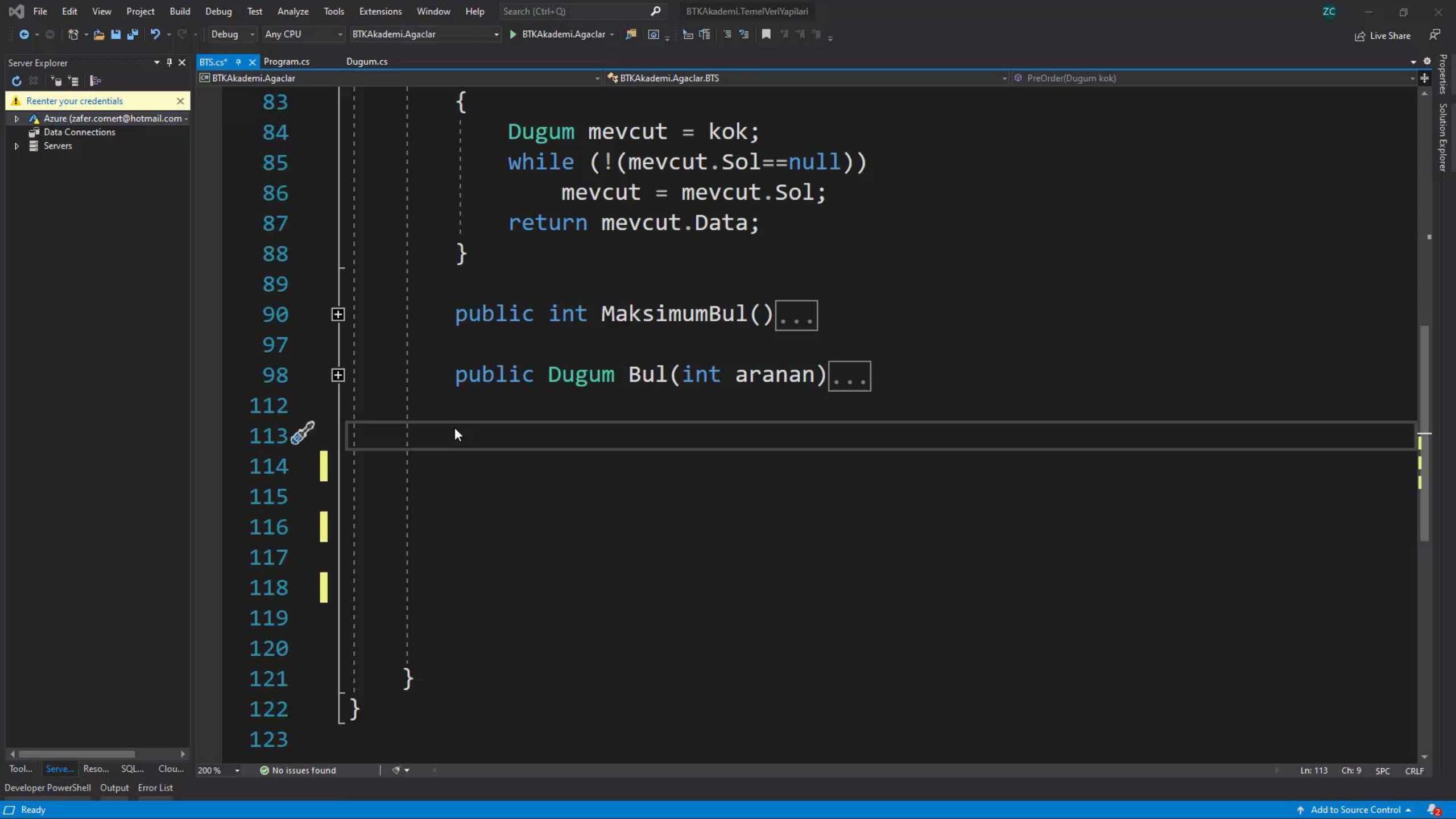


Silinecek düğümün bir alt ögesi vardır.

Ağaçtan eleman silme



Silinecek düğümün iki çocuğu vardır.





Ağaç